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WATERS OF WESTERN INDIA.

(SUPPLEMENTARY NOTE.)

AFTER the publication of that part of these notes dealing with the Konkan and Bombay Coast, several members made valuable additions to my rough list of birds, and my own observations enable me now to supplement that Chapter with some new details.

Amongst Cetacea, the Bhulga ( *Neomeris karachiensis* ) is now represented by several specimens in the Victoria Museum and our own. Formerly, I believe, Mr. Murray's type specimen was unique. Of the "Gadha," or large deep-water porpoise, we have got a fine specimen, identified by Mr. Sterndale as *Delphinus lentiginosus* ; which is, however, not always now distinguished as a separate species from *D. ( Sotalia ) plumbeus*.

Amongst Birds, I have myself obtained a Swallow Plover ( *Glareola orientalis* ), out of a flock of a dozen on the wide pastures of Rewadanda; and a specimen of the Grey Plover ( *Squatarola helvetica* ) was brought to me from the same place, which is a favourable *habitat* for most Plovers. Mr. Inverarity first corrected my belief that the Indian Golden Plover was at least rare here; and since that I have found it myself in April and September in the valley of the Kundlika, half-way between Rewadanda and Rone. At this point there is a large area of grassy saltmarsh, where the

Golden Plover is said by the native fowlers to breed ; and this is not impossible, as it does so in much more southern latitudes, and the ground is as good an imitation as our Province can afford of the breeding grounds frequented by its European cousin.

Of the *Hæmatopodidæ* ( misprinted *Hæmantopodidæ* in my paper ) I have seen a good deal since it was written. I have verified the presence of the Crab Plover by inspection of a fresh specimen brought in to me from Nagaum Sands, and have received seven of the Oyster-catcher, which deserves remark.

Jerdon gives the truncated bill as a characteristic of the genus *Hæmatopus*, of which he mentions that "several species are recorded, chiefly from America, one or two from Australia, and one from Africa." He identifies our bird with that of Europe ; and gives the colouration of its bill as "orange-yellow dusky anteriorly." These were the colours in all my specimens ; and those of their plumage agreed with what he says of young birds before and after the first month ; but *in no case was the bill truncated*.

I have several times killed and handled adult specimens in Ireland, and in all of these the truncation was as marked as in a clay tobacco-pipe broken short off, and the colour a bright-red. Mr. Murray, in the "Vertebrates of Sind," gives this colour ( which I have not seen in India ), but does not notice the truncation of the beak.

The editor of the *Field* in a short answer to a note on the subject, suggests that this may be the result of wear in use. Lieutenant Barnes, whom I had the privilege of consulting, appeared to lean to this view ; but in his book he has followed Jerdon.

The upshot of the matter is, so far, that the truncation of the beak must disappear, as a *generic* character, from future notices of the species. If it is to be retained as a *specific* character, our bird is different from that of Europe, as our Golden Plover is; for a mere result of wear cannot be treated as identifying either a genus or a species, and if this is the cause of truncation, our bird may well enough be identical with *Hæmatopus ostralegus*, and the colouration of the bill characteristic of the young bird only. The bird is a permanent resident, and probably breeds here.

Amongst Longirostres I have lately obtained the Avocet Sandpiper ( *Terekia cinerea* ) for the first time. The specimen was one of a small flock on the Nagotna Creek, and I have observed a dozen Avocets ( *Recurvirostra avocetta* ) on the salt-pans near Pen.

Under the head of *Anatidæ*, I have an important correction to make, as a freshly-killed Mallard was lately brought in to me at Nagotna. It was in full plumage, bar a few plumes ; the curly tail feathers were well developed, and after careful examination and comparison with Jerdon's description, there could be no doubt about the bird. It is true that tame drakes sometimes assume a plumage closely resembling that of their wild ancestors ; but these can, I think, generally be distinguished by the bill, which is more yellow in the domesticated bird, except where the wild blood has been very lately renewed by crossing. The *proof*, however, is like that of puddings, in the *eating*. I instituted autopsy of my bird upon that principle, and have no doubt whatever that he was a genuine Mallard. This is, perhaps, the most southern record of the species. "Our only Gannet" has been identified as *S. cyanops*.

Amongst fishes and reptiles I have no novelty worth recording here ; but of Molluscs I have received many specimens of *Chitons* and *Lingulæ*.

KESWAL.

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## THE BIS COBRA.

BY G. W. VIDAL, C.S.

(Read at the Society's Meeting on 4th January, 1888.)

In that charming and inimitable little book, "The Tribes on my Frontier," which delights all who read it,—and of which our Society has special reasons to be proud—there is a characteristic description of the bis cobra, which will serve admirably as the text of the remarks I have to make. "But of all things in this earth that bite or sting the palm belongs to the bis cobra, a creature whose very name seems to indicate that it is twice as bad as the cobra. Though known by the terror of its name to Natives and Europeans alike, it has never been described in the proceedings of any learned Society, nor has it yet received a scientific name. In fact, it occupies much the same place in science as the sea serpent, and accurate information regarding it is still a *desideratum*. The awful deadliness of its bite admits of no question, being supported by countless authentic instances ; our own old *ghorawalla* was killed by one. The points on which evidence is required are—first, whether there is any such animal as the bis cobra ; second, whether, if it does exist, it is a

snake with legs, or a lizard without them. By inquiry among natives I had learned a few remarkable facts about it ; as, for instance, that it has eight legs and is a hybrid between a cobra and that gigantic lizard commonly miscalled an iguana ; but last year a brood of them suddenly appeared in Dustypore, and I saw several. The first was killed by some of the bravest of my own men with stones, for it can spring four feet, and no one may approach it without hazard of life. Even, when dead, it is exceedingly dangerous, but, with my usual hardihood, I examined it. It was nine inches long, and in appearance like a pretty brownish lizard, spotted with yellow. It had no poison fangs, but I was assured that an animal so deadly could dispense with these. If it simply spits at a man, his fate is sealed ; for, excepting a few cunning Bengalees, no one knows any *muntra* or charm which has power against it. Afterwards one appeared in my own garden, and I made an attempt to capture it alive with a butterfly net, my devoted butler's hair turning grey as he watched me from a great distance ; but the bis cobra got off into a hole. It escaped me once or twice again, and then finding I was bent on catching it, it gradually changed colour like a chameleon and grew larger at the same time, until in a few weeks it had developed into an unmistakable iguana. Some people would jump to the conclusion that it was a young iguana to begin with. My butler would endure the thumb-screw sooner."

It is, perhaps, an unusual proceeding to undertake to read a paper on a certain animal and then to deny its existence *in toto* ; but this is what I have to do. There is no doubt that a large number of human beings do believe—and probably always will believe—in the existence of venomous lizards in India, and of the bis cobra in particular. If any such believers are present here to-day I hope to be able to convince them that the mysterious bis cobra, of which we hear now and again, is merely our old friend Mrs. Gamp's own particular Mrs. Harris in another sphere of life—a transmigrated Mrs. Harris, in fact, and that, as far as India is concerned, there "aint no sech a person." The origin of the word bis cobra is in itself a mystery. It is neither wholly Oriental nor wholly European, but apparently a barbarous compound, which may be justly repudiated by all decent languages. "E H A" in his playful manner affects to believe the name implies that the animal is *twice* as poisonous as a cobra. But the learned author of Hobson-Jobson will not admit that the name has anything to do with either *bis* in the sense of *twice*

or *cobra* in the sense of *snake*; he contends that *bis* is *bish*, the Hindustani word for poison, and that *cobra* is probably a corruption of *khopra* or *khepra*, the vernacular word for "a shell" or "a skull." Hobson-Jobson is no doubt right about *bis* being *bish*, poison. But his derivation of *cobra* from *khopra*, a shell, seems far-fetched and fanciful. Had the term *bis cobra* ever been used to denote a venomous cockle or a poisonous periwinkle, the derivation would have been plausible enough. But though cockles, winks, *et hoc genus omne*, may be poisonous in the sense that they sometimes disagree with frail mortals, if indulged in too liberally, I don't think they have ever yet been called *bis cobras*, or endowed by the wildest romancers with the attributes popularly ascribed to the latter. I am inclined, therefore, to believe that *cobra* in *bis cobra* does after all mean *cobra*, which, as we all know, is the Portuguese rendering of the Latin *coluber*, a snake, and I can only conjecture that the original discoverer of the *bis cobra* was rather mixed as to the distinctive characters of snakes and lizards. Possibly the creature to which he applied the name, and which has unfortunately not been preserved as a type specimen, was one of the skinks, a family of lizards, which would be very like snakes indeed, to all outward appearance, if they lost their legs. The derivation of the name would be of little consequence if we could fix the creature itself, and confidently refer it to any single species. We are unfortunately used to all sorts of atrocities in the nomenclature or mis-nomenclature of animals. We might leave etymologists to wrangle over the name, if the identity of the *bis cobra* were not such a hopeless puzzle. One day it is one lizard. and the next day another. Almost every harmless lizard in its turn seems to be branded as the genuine *bis cobra*. It is useless to demonstrate that any particular species declared by "One who knows" to be the real article, is a common harmless lizard; for the next day a totally different, but equally harmless, species will be produced as the true *bis cobra* by "One who knows better." All the families into which lizards are divided contribute from time to time to swell the ranks of venomous lizards. It is impossible to give any exhaustive list, but I will here mention a few which figure more often than others as *bis cobras*. First, there is the common and well-known Indian water lizard or monitor (*Varanus dracæna*), the "Ghorpad" of the Mahrattas, the "Goana" of Ceylon. This is the species which is so frequently miscalled the iguana by Europeans in India, and probably identical with "E H A's" brood of Dustypore

bis cobras. We have several specimens in our collection. The stuffed monitor before us is too large for a bis cobra. But young monitors, which are more conspicuously marked than their elders, by white *ocelli* and dark cross bands, or often called bis cobras in Sind and Cutch. The natives of Southern India are also said by Dr. Shortt to hold monitors in deadly fear. Not only is their bite fatal, but they hold on with such bull-dog tenacity, that they will not relinquish their enemy till a donkey brays, which soothing noise, according to local superstition, operates on them as a charm and turns away their wrath. It is needless to say that the monitor is quite innocent of venom, though its bite is no doubt severe, and though it can administer a very punishing stroke with its tail. Many funny stories are told of this species. Perhaps the funniest of all is the old Mahratta legend that the ancestor of the well-known family of *Ghorpares*, originally a *Bhonsle*, like Sivaji, changed his name to *Ghorpare* after a very daring exploit he achieved with the aid of a *Ghorpad*. This exploit was nothing less than the scaling of a fort in the Konkan—hitherto deemed impregnable—by availing himself of the services of a friendly *Ghorpad* to pull him up the wall by means of a rope fastened to the animal's tail. Now these lizards have, as you see, very strong claws with which they can no doubt hold on even more firmly than with their teeth. Their skin is also remarkably tough, and for this reason is, I believe, in great demand for tom-toms. But I should not advise any enterprising member of this Society to follow the example of the ancestor of the *Ghorpares*, at all events unless the ditch below the fort wall he selects for the experiment has a good ten feet of water in it. *Ghorpad*—as perhaps you know—is eaten and thought a great delicacy in various parts of the country, especially in Ceylon. This seems strange considering the horror in which it is held in other parts. Kelaart, the naturalist, tells us that he had some excellent soup made of a *Ghorpad*, and that it tasted very like hare soup. This, however, is another example which I should hardly recommend any one to follow. Another and more handsomely marked species of this same family, the ornate monitor (*Psammosaurus scincus*), the *Chandengo* of Guzerat, is also not unfrequently passed off as the bis cobra, probably from its resemblance to the young of the common *Ghorpad*. Thus the monitors which are forked tongued lizards contribute at least two species to the army of bis cobras. Next come the Geckos, with short thick tongues and adhesive toes, some of which live in

our houses and others in rocks and trees. This family contributes more bis cobras than all the rest put together. In the North-West Provinces, as I find from a letter from "Young Nimrod" in the *Asian* of November 23rd, 1880, all Geckos are called bis cobras indiscriminately. Another correspondent of the same paper declares that *the* bis cobra *par excellence* of the North-Western Frontier is Hardwick's Gecko (*Eublepharis Hardwickii*, Gray), a stout-bodied nine inch lizard, which is not very common. The same species is also, according to Dr. Shortt, *the* bis cobra of India. "Some years ago," he writes in an interesting note in the *Madras Monthly Journal of Medical Science*, "I saw some articles in the Madras papers about this reptile (*Eublepharis Hardwickii*), which made it out to be the most poisonous creature with or without four legs, and one or two of the officers who were in service in Bengal mention that several sentries were found dead at their posts from the bite of some creature, which was afterwards found, and which I took to be, the bis cobra from the description they gave of it." In Burmah, again, there are two large Geckos (*Gecko guttatus*, Dana; and *Gecko stentor*, Cantor) which are widely believed to be exceedingly venomous, and are consequently held in great dread. These deadly reptiles are not, however, called bis cobras, or by any other names conveying an idea of their poisonous nature. Their local name "Tuctoo" is a very innocent one, and merely an imitation of the loud note with which they and other members of the same family frequently relieve their feelings; and which sounds like "tuck," "tuck," "tuck," repeated in a crescendo scale. Dr. Shortt had a specimen of *Gecko guttatus* sent to him for examination by a correspondent with the following description:—"This is the Tuckatoo of the Burmese, a large species of lizard found in Burmah, inhabiting trees and seldom ever seen, and heard only at dark and during the night: it is of a dark ash colour spotted with red, but the old ones are much darker in colour, as are also the spots. Their first cry begins with a croak, and then they sing out tuckatoo, tuckatoo, quite slow, and then in a quicker time. The same word is repeated for a few seconds, and then another croak, and all is still. Their voice is quite loud and hoarse and heard at a great distance. The Burmese, as well as other natives, dread this reptile as their bite is poisonous, and their hold so tenacious that they can only be cut off the body of the person they fall on. The Burmese say that when any one is bitten their body swells to a great size, and they seldom live over a day." In Southern India again,

according to the same authority (Dr. Shortt), the Bengal Gecko (*Hemidactylus cocteauvi*, D. et B.) is dreaded, more especially the larger kinds found about rocks and trees. Then again some gross calumniator has dared to take away the character of our old friend the chameleon (*Chameleo vulgaris*, Lin.), the *Sasumba* of Cutch, and *Guhira Sarad* of the Deccan. Any one who has watched the child-like and bland expression of the pet chameleon, whose life was made so happy in these rooms by Mr. Phipson's tender care, will find it hard to believe that he is a deadly monster, whose bite is instant death. Nevertheless, he has not been allowed to escape the stigma of being called a bis cobra. According to Dr. Fairbank, he is the bis cobra of Guzerat, and Dr. Shortt relates a story showing the extreme dread in which he is held in Madras: "When Zillah Surgeon of Chingleput," he writes, "I remember on one occasion a native came running to my house: he was almost breathless, streaming with cold perspiration, looking pale, skin cold, pulse small, holding the thumb of his left hand in his right, and complaining of being bitten by a chameleon on the tip of his left thumb, and requesting with tears in his eyes that I would do something to save his life. Nothing that I could say convinced him that the chameleon was harmless and the bite not poisonous, but to satisfy the poor fellow I applied some *liquor ammonia* to the part said to be bitten, where there was a slight abrasion of the skin, and gave him a little brandy and water to drink. He sat down for a time in my verandah, and then went away apparently quite well. That the man was in a great fright about his life there was no doubt from the state of his pulse, skin, and general appearance, when he presented himself to me." It is needless to state that all the lizards mentioned above are perfectly harmless. The Skinks, the ground lizards, the sand-fish lizards and the pretty little Dragons, or flying lizards, have hitherto, it appears, escaped the unenviable notoriety of being called bis cobras. So also has the familiar Bloodsucker (*Calotes versicolor*, Dana). This is odd, as in his scarlet war paint the Bloodsucker is one of the most formidable-looking lizards we have. That very uncanny Australian lizard, the Moloch, of which we have a good specimen here, is another species which if found in this country, would hardly escape being called the true bis cobra. I have little doubt, however, that some day, when the most credulous have begun to believe in the innocence of monitors, geckos and chameleons, all the lizards mentioned above will have their turn. They offer at least a wide field for the selec-



tion of future bis cobras. The belief in poisonous lizards is by no means confined to India. It may safely be said that there is no known species of lizard in the old world which is provided with glands for secreting venom, or fangs through which to eject it. Nor are there any lizards in India whose dentition is in any way suspicious.

It must, however, be admitted that there is rather strong evidence, if not actual proof, as to the existence of a venomous lizard in Mexico. This is the Mexican Heloderm (*Heloderma horridum*, Wiegmann), a species of the monitor family. Mr. Tegetmeier has written an interesting account of this reptile in the *Field* of August 19th, 1882. The Heloderm was first described by Dr. Wiegmann in 1829. It had long been held to be venomous by the inhabitants of the tract in which it is found, that is, the hot zone of Mexico. Dr. Wiegmann called attention to its peculiar dentition, which seemed to confirm in great measure the popular belief in its poisonous nature. For although there were no signs of poison glands, as in the case of venomous snakes, it was found to have recurved grooved teeth, through which its saliva, whether poisonous or not, could be introduced into the puncture made by its bite. Dr. Wiegmann himself does not appear to have believed that the Heloderm was really a venomous species, and he made no experiments to test the matter. Many years later, a French naturalist, Sumichrast, took up the subject again, and wrote a more detailed account of the Heloderm in the *Comptes Rendus* of 1875. He also procured and sent preserved specimens to Paris. According to Sumichrast the animal has a strong nauseous smell, and when irritated secretes a large quantity of gluey saliva. "In order to test its supposed poisonous property"—I am quoting from Mr. Tegetmeier—"he (Sumichrast) caused a young one to bite a pullet under the wing. In a few minutes the adjacent parts became violet in colour, convulsions ensued, from which the bird partially recovered, but it died at the expiration of twelve hours. A large cat was also caused to be bitten in the foot by the same Heloderm; it was not killed, but the limb became swollen, and the cat continued mewing for several hours, as if in extreme pain." Mr. Tegetmeier further writes that the dead specimens sent to Europe were carefully examined as to the character of the teeth. Sections were made which demonstrated the existence of a canal in each tooth, totally disjunct from, and anterior to the pulp cavity; but the soft parts were not examined with sufficient care to determine the existence or otherwise of any

poison gland in immediate connection with the perforated teeth. Nothing further was heard of the Heloderm until 1882, when a live specimen, 19 inches long, was presented to the Zoological Gardens by Sir John Lubbock. The arrival of this interesting stranger caused quite a little sensation at the time amongst the naturalists of Europe. Mr. Tegetmeier tells us that for some days it refused all kinds of food. A live frog, a guinea pig, and several rats, however, fell victims to its bite. The frog died in convulsions immediately after it was bitten. The guinea pig (bitten in the hind leg) died convulsed in three minutes, while some young rats perished even more quickly. After a time it was found that eggs were the particular food which the Heloderm fancied, and these it disposed of very readily. It was expected that further systematic experiments would be made to test the poisonous character of this lizard, and that the results would be published. Whether such experiments have been made or not, and with what result, I should be glad to know; for I have not been able to come across any record of them.

Fortunately no "horrid" Heloderm has yet been found in India, nor any other lizard with similarly suspicious teeth, to justify the believers in the bis cobra. The origin of the belief in poisonous lizards in the country is not easy to trace. Dr. Shortt, writing of Southern India, thinks that a certain learned work in Tamil, called the Sittar Vedum, or work of the "Seven Sages," which can be had in the bazaars for two or three annas, and which is a very popular book, is to a large extent responsible for the absurd beliefs of that part of the country. This book, he tells us, gives an account of all poisonous animals, including in the same category snakes, centipedes, spiders, beetles, lizards, dogs, cats, tigers, and monkeys. A similar work is said to exist in Ceylon. As regards Bombay, the Deccan, and the Konkan, I am inclined to think that Europeans are quite as much, if not more, responsible than natives for the propagation of wild stories as to snakes and lizards. I have myself very seldom heard a native of these parts asserting the deadly character of any lizard, though they are very ready to take away the character of the most innocent snakes. The touch of a lizard is, I believe, generally considered a pollution by Hindus, but the bis cobra, according to my experience, is a creature of European, quite as much as of native, imagination. Hindus, however, whether they believe any lizard to be venomous or not, have some wonderful superstitions concerning them. The omens portended by the various ways in which a lizard

can present itself to man or boy, wife or maid, are so many in number, that it must take a man or woman all his or her life to learn them. This must be rather awkward, as the fulfilment of the omen must in many cases precede the knowledge of what is coming; and if the omen is a bad one, deprive the victim of all chance of averting it by recourse to the various mysterious ceremonies prescribed for the purpose. If any one is interested in the subject, a paper on "Omens from the falling of house lizards," contributed to the *Indian Antiquary* by Mr. K. Raghunathji, will repay perusal. From the exhaustive list of omens given in this paper, we can see what will happen to us when a lizard falls on any part of us from head to foot. These omens have little or nothing to do with the subject of his cobras, and there is no time now to describe them in detail or to attempt to trace their origin. I cannot, however, refrain from mentioning a few of them for your comfort, or discomfort, as the case may be. Men will be glad to hear that if lizards fall on their noses it is lucky. But the dividing line between joy and grief is so very thin that if the lizard touches the tip of the nose the result is extremely calamitous. This is like a warning to men with prominent hooks not to carry their noses too high in the air. Men also may or may not be pleased to hear that if a lizard falls on their left cheek, they will be blessed with a sight of their deceased relations. But the luckiest thing of all is for a lizard to fall on the soles of a man's foot; for then all his enemies will surely perish. This is an event which I fear is not very likely to happen to many of us, unless we habitually stand on our heads or make a point of sitting expectantly for hours together every day in the position taken up by the Japanese gentleman in Chiarini's Circus. Ladies will be glad to know that if a lizard falls on their left cheek, they will meet not their deceased relatives, but their beloved. There will be misery if one falls on their right eye, but grass widows may be consoled by the thought that a lizard on their left eye is a certain sign that they will meet their absent husbands. Lastly, immense wealth and a son are hers on whose left foot a lizard falls, and she will be rich in grain if one falls on her toe nails.

#### VENOMOUS LIZARDS.

TO THE EDITOR OF THE "BOMBAY GAZETTE."

SIR,—In your article of 7th inst. you call attention to the following words, which occur in the paper I recently read at a meeting of the Natural History Society. "It may safely be said that there is no known species of lizard in the

old world, which is provided with glands for secreting venom, or fangs through which to eject it." You ask, with reference to this passage, if the time has come for saying that none of the Indian lizards are poisonous. If you refer to *known* species—that is, species which have been examined, described, and named by competent authority, your question may be confidently answered in the affirmative. My remark is, of course, limited to such species. He would be rash, indeed, who would deny the possibility of a venomous lizard being discovered in the old world. There are still tracts in the Himalayas, and elsewhere in Asia, of which the zoology has been very imperfectly, if at all, observed, and where the local bis-cobras, if not his-cobras, may at least turn out to be "boojums." Nothing that I have said is in any way inconsistent with the admission that another "horrid" heloderm may be found in India, slight though the chance of such discovery may be. The assertion that there is no *known* species of venomous lizard in the old world is, I need hardly say, *not* made as a hasty deduction from personal observation. It expresses, as far as I can ascertain, the conclusion of all the leading authorities on the subject. This conclusion is obviously strengthened by the fact—to which I drew prominent attention in my paper—that all the specimens of lizards commonly produced as his-cobras belong to species already well-known to be innocuous.

You are quite right, however, in stating that the Statistical Abstract shows that in 1884 and 1885 four to seven persons, respectively, were killed by lizards. I might add that in each of the preceding years, 1882 and 1883, one person is said to have died from a similar cause. Most of these casualties occurred, I believe, in Guzerat. I have a dim recollection of having myself, while in Broach, examined an inquest report declaring a man or a woman to have been killed by a *chandengo* (the local name of the two harmless species of monitor lizards, *Varanus dracana* and *Psemmosaurus scincus*).

Some irresponsible critics affect to believe that the annual official returns as to deaths caused by wild animals and snakes are not worth the paper they are printed on; that all sorts of murders and dark deeds are covered conveniently and safely by the mortality for which snakes and "other animals" are officially held responsible; and that "snake poison" is merely a happy and conventional way of alluding to the "cup of cold poison" which terminates domestic disputes, and gets rid of people who make themselves disagreeable. My faith in the accuracy of the returns has never been materially weakened by these and similar reckless insinuations. I will therefore admit, for the sake of argument, that these alleged victims were really bitten by lizards, and died after being so bitten. I prefer to meet whatever evidence the returns may give against me boldly and on its merits, and scorn to shelter myself behind the plea that a man, declared by a village *punchayat* to have been killed by a lizard, may have had a dose of arsenic.

But I reject the inference which the believers in the his-cobra will naturally draw from these reported deaths. Admitting that death in each of these cases followed the bite of a lizard, it by no means follows that death was due to the action of any *poison*. Those who, like myself, refuse to believe, on the evidence before us, that there are any venomous lizards in this country, will say that the direct and immediate cause of death in these cases was *fright*, and fright only aided

possibly by a diseased condition of the heart. I believe that nothing is more certain than that grossly ignorant and superstitious subjects, bitten by harmless snakes and even by lizards, do occasionally die from pure fright. Many doctors, I fancy, could quote instances in support of this statement from their own experience.

Here are two cases recorded by Dr. Russell, the pioneer of ophiology in India, from which those interested in the question may draw their own conclusions. Case No. 1.—‘Two sepoys at Rajamuudri were bitten in the same night by the same snake, which was described as being ‘scarcely six inches long, about the size of a large goose quill, of a dark straw colour, a flat head, with two very small eyes, which shone like diamonds, and behind each eye was a black streak about three-fourths of an inch long.’ The first man bitten died after six hours. He said and felt that death was inevitable directly he was bitten. The second man bitten within a minute of the first, died within eleven hours. Neither man, it appears, suffered visible pain or convulsions, but passed away in a kind of stupor.” Case No. 2.—“The porter of Mr. Bouchier, Governor of Bombay, a *very stout Arab*, was bitten by a very small serpent, and died *almost instantaneously* after exclaiming that a snake had bit him.” The italics are mine. Dr. Russell’s information was got from the Governor’s son, Mr. James Bouchier, who spoke from memory, and added “that the snake to which the man’s death was imputed was by the Portuguese called *cobra de morte*; that in the course of twenty years he had only seen two of them, one on the island of Bombay, the other in his own house at St Thomas’s Mount, near Madras; that the length of the snake was from six to nine inches; its thickness that of a common tobacco pipe; the head black with white marks, bearing some resemblance to a skull and two cross bones; the body alternately black and white, in joints the whole length; and that its venom is of all others the most pernicious.”

Dr. Russell, it must be admitted, has not suggested that the death of the two sepoys, and the very stout Arab, evidently stouter in body than heart, was due to fright. He made no comments, and possibly believed that the snakes described were as deadly as they were said to be. Very little was known in those days on the subject of venomous snakes. Local superstitions were too deeply rooted to be shaken by the little exact knowledge then available. The diminutive *cobra de morte* was then a living tradition, and its existence not to be rashly questioned. But can any one now believe that the diminutive snakes described, even if immature specimens of venomous species, were capable of causing the death, *by their poison alone*, of the two sepoys and the stout Arab? From the descriptions given it is impossible to say what the snakes in question really were. But they are certainly more likely to have been harmless than venomous species, and the description of Mr. Bouchier’s snake, to whose bite the stout Arab succumbed “almost instantaneously,” reads uncommonly like that of the familiar and innocent little *lycodon aulicus*. This theory of death by fright is not a new one. In commenting on the same cases, in a chapter on the snakes of the Poona district, contributed to the *Bombay Gazetteer* some years ago, I ventured the same explanation of the cause of death, observing that the “*cobra de morte* like the mythical bis-cobra or poisonous lizard, has no real existence; but whereas the latter name is still

applied to various species of lizards, known to be innocuous, the cobra de morte is now, whatever it once was, a name and nothing more." Dr. Fairbank also in his "Bombay Reptiles," writes of the Ornate Ghorpad as follows:—"It inhabits Sind and Cutch, and there it is called *chandengo*, and its bite is thought poisonous. No lizard has a poison sac or fangs. The saliva may become an irritant when the lizard gets much vexed as that of a wharf rat does. Some lizards spring fiercely and bite severely, and some snakes that are not venomous do the same, and many persons bitten by such reptiles have died, *not from poison, but because they believed themselves poisoned.*"

The extract from Dr. Shortt's note which I quoted in my paper on the bis-cobra, is another good instance in print. There was a man bitten by a chameleon. As there is only one species of chameleon in India there can be little, if any, doubt as to the identity of the lizard. Few will be bold enough to assert that the chameleon is a *venomous* reptile. But the man *believed* it was, and his belief remained unshaken. Despite all Dr. Shortt's assurances, the symptoms of fright were alarming enough. He was "almost breathless, streaming with cold perspiration, looking pale, skin cold, pulse small," &c. In this case the poor man did not die. Why?—Because he had faith in the doctor's remedies, and was comforted by brandy and water. A bread or sugar-pill would probably have had the same effect. But what might have been the fate of that man without the doctor and his brandy and water?—He would have gone to his house and his friends and relations would have crowded round him, shrieking and wailing, telling him it was all up with him, till the poor wretch would have been seized with convulsions and died. I have myself seen a woman as near death as possible under very similar circumstances. She was working quietly in the garden. All of a sudden she gave a shriek, and muttering something incoherently about a snake, went off into violent convulsions. The doctor was sent for, and he succeeded with some difficulty, and after some hours, in getting her round. The snake was killed. It was a harmless one, and had not even scratched her! She admitted afterwards that she had not been touched by the snake. But she had been told—and of course believed—that if a certain snake's shadow fell on her, she would certainly die. The shadow of a snake did fall on her, and she would in all human probability have died had skilled medical aid not been at hand.

Thana District, Jan. 10,

G. W. VIDAL.

## THE NEAREST ALLIES OF THE HORSE.

BY VETERINARY SURGEON J. H. STEEL, A.V.D.

(Read at the Society's Meeting held on 6th February, 1888.)

IN the whole range of Natural History there is no more compact nor isolated group than that of the Equidæ, which, therefore, presents itself as a neat subject for special study. We approach this enquiry with great advantages in that we are very familiar with

two types of the group, the horse and the ass, in that the geographical distribution of the Equidæ is very marked and limited within certain ranges, and in that the members of the group are so striking and interesting as to have received a good deal of notice from travellers and naturalists. The difficulties in our way are that some confusion has arisen in nomenclature, that observers have not been exact and detailed enough either from a naturalist's or from a horse-man's point of view, that many of the Equidæ are very wild and difficult to approach, and, finally, that they are difficult of transport and at first intolerant of confinement in our larger zoological collections. The beautiful work by Cornwallis Harris on the large game of South Africa must be specially mentioned on account of its value to the naturalist and to the sportsman, and because I am indebted to it for some of my illustrations.

*Characters*—The Equidæ are odd-toed solidungulate animals in which the hoof attains its highest development. Several other anatomical features of their limbs point to their swiftness of foot; for example, the femur has a third trochanter, the two facets on the front of astragalus are very unequal. They are all granivorous and have, accordingly, a fairly simple stomach and capacious intestine, together with a special form of dentition not suited to rumination, but with well marked diastemata or breaks in the tooth series. The dorso-lumbar vertebræ are not less than twenty-two in number, and horns are not present as a normal character. Among the order Ungulata, to which the Equidæ belong, the rhinoceroses and tapirs of extant genera and the palæotheridæ and the macrauchenidæ of the past are included with the Equidæ as odd-toed or perissodactyla, the differences between the horses and other odd-toed ungulates are, however, very marked. All Equidæ are gregarious, the units of the herds being family groups of eight to ten, and the size of the full herd being determined by plentifulness of grass and freedom from disturbance. The habitat is country firm under foot and somewhat dry. There is a tendency to migrate in accordance with food supplies to the plains in wet weather and to mountains in dry weather, but in all countries occupied by Equidæ the plains are desert and sandy throughout a considerable part of the year.

It will be observed that in every respect, and even in the minds of naturalists, there is a tendency for the different equine forms to run into one another, whence has resulted much difference of opinion as to *classification of the group*. Species run into species,

varieties are very common in some cases, the characters by which one form is distinguished from another are observed to sink in importance the more thoroughly they are investigated, and it would seem that there is quite as much reason for separating the European man from the Australian savage as there is for placing the zebra and horse in distinct species. Sharply as the Equidæ as a group are defined, it is wonderful how few essential points of difference they present among themselves. Some naturalists refuse to accept the differences as more than specific, and thus describe each form as *Equus*. Others consider as horses those which have chestnuts and castors, *i. e.*, "warts," on both fore and hind legs, and classify the asses and zebras together as being devoid of castors. The retention of castors, though apparently a very petty matter, seems certainly to have a value in systematic classification. Hamilton Smith goes further and insists on giving the zebras and their allies a distinct generic name, *Hippotigris*, and, considering their distinct geographical range and apparently long special descent, the South African Equidæ seem worthy of this distinction, which leads us to the following classification:—

## EQUIDÆ.

HORSES ( <i>Equus</i> ).	ASSES ( <i>Asinus</i> ).	ZEBRAS ( <i>Hippotigris</i> ).
1. <i>Equus</i> .	1. <i>Asinus</i> .	1. Zebra.
	2. Onager.	2. Burchell's Zebra.
	3. Hemippus.	3. Quagga.
	4. <i>Tæniopus</i> .	
	5. Hemionus.	

It must be remembered that the early naturalists especially have confused certain of these forms, or, at any rate, their names. Thus hemionus was applied first by Pallas to the kiang, but since then has been used for the onager or for hemippus. A less serious confusion is the use of the term onager for the Assyrian wild ass (*As. hemippus*) instead of the wild ass of Cutch; but competent naturalists, such as Solater, doubt whether there really is any difference between the onager and the hemippe, while others consider *tæniopus* is also simply a variety of onager. Thus the asses would tend to become only three forms, the true ass, onager, and the kiang. Even this reduction is by some considered insufficient, and *Asinus vulgaris* is taken to have direct and immediate relation with the onager, either as progenitor or descendant; some observers specially notifying *Tæniopus* as the variety most directly related in descent to the common domesticated ass, in support of which view we shall



see that the equines admit of enormous variation under natural and artificial influences. Again, hemionus (the kiang) is sometimes spoken of as the wild horse, and has been confused with the terpan or wild horse of Tartary. Cunningham is responsible for calling it the wild horse, and others agree with him that its voice is more like a neigh than a bray. Some state that the sound it makes is like that of a mule. Moorcroft, Strachey, and others say his cry is most like braying, and the balance of evidence is in favour of his being a true ass, though, as Jerdon points out, his darker colour, small ears, and large size, as compared with the onager, render him, when at a distance, liable to be mistaken for a horse. We have elsewhere observed that the Tartars use the term koulán indifferently for the terpan and the kiang, another element of confusion. On the other hand, as we have seen, naturalists have in different cases applied the term hemionus to the onager and the kiang, and it seems that the Tartars also call onager, the koulán. Jerdon enumerates as follows the differences between the ghorkhur (onager) and the kiang:—

Marks.	Ghorkhur.	Kiang.
Dorsal stripe . . . . .	Broader on the back, does not extend to tail-tuft, bordered with white, which extends broadly to tail and along hind margin of buttocks.	Broader over tail and extends to tail-tuft. [Sometimes very obscure or wanting (Strachey)].
Shoulder stripe . . . . .	Darker blackish and well marked.	Often only faintly visible. [Sometimes distinct (Strachey)]
Limb marking . . . . .	Generally present. White of under parts and belly well marked.	Absent.

Blyth in his paper on wild asses (Journal Asiatic Society, 1859, p. 229, *et seq.*) seems to have confused the ghorkhur and the kiang. J. Hooker rightly considered them distinct (Jerdon).

We may now proceed to notice each form in turn:—

(1) *EQUUS CABALLUS*, the common or domestic horse, *Eq. antiquorum*.

*Mane and tail* long and flowing; hairs of tail over whole posterior surface of stump.

*Horny appendages*—Ergots typically present on all four limbs, chestnuts inside fore arms, castors inside hocks, warts rarely absent on hind legs; “the bay mare, Eaglet, was without sellanders on the hock joint.”—(*Jamaica Times*, 1845, Aug. 25.)

*Colour*—Various, principally bay and dun; occasionally rufous, mouse colour, white, dappled grey, &c.

*Marking*—Dorsal stripe in some breeds; very occasionally faint traces of shoulder stripes; occasionally zebra marks about knee and hock (especially on outside).

*Size*—Varies much; from about 9 hands to 17 hands, or average of over 14 hands.

*Habits*—Gregarious, docile, and domesticable; inquisitive; enormous geographical range; much influenced by domestication.

*Voice*—A neigh.

*Ears*—Short and fine.

2. *ASINUS VULGARIS* (Gray): *Equus asinus*, the common ass; *As. domesticus* (H. Smith). The lineal descendant of *As. tæniopus* (Sclater and Darwin).

*Mane and tail*—Mane short, upright, irregular; tail has tuft at extremity.

*Horny appendages*—No castors.

*Colour*—Mouse grey; varies to an extent.

*Markings*—List or "dorsal stripe," cross shoulder stripe, which varies much in length, breadth, and manner of termination. Sometimes absent, occasionally double or treble: may be forked at its extremity, or bent into an angle as in the quagga and Burchell's zebra. Often zebra marks, especially on the fore limbs.

*Size*—Varies much from 9 hands to 17 hands.

*Habits*—Strong, hardy, sure-footed, much warped by domestication. "In South America numerous asses have been allowed to escape into the plains and multiply in a state of nature; but they never acquire the habits of their freeborn progenitors in the desert; they linger near the places of their birth and fall an easy prey to their enemies." (Low.) Only lately known in Sweden and Norway; not found in Burma. Four Syrian varieties (Darwin):—

"(1) A light and graceful animal, with agreeable gait, used by ladies; (2) an Arab breed reserved exclusively for the saddle; (3) a stonter animal used for ploughing and various purposes; (4) the large Damascus breed with peculiarly long body and ears."

*Voice*—A bray.

*Ears*—Long and thick.

*Head*—Forehead arched.

3. *EQUUS ONAGER* (Pallas); *Asinus onager*; *As. indicus* (Schäfer); *Eq. hemionus* of India (Auct); ghorkur, Asiatic wild ass of Cutch, *As. sylvestris* (Pliny); *As. hemionus* (Gray); gour (Persian); *Eq. khur* (Lesson); mistakenly koulán.

*Mane and tail*—Tail tuft short; mane blackish brown. Mane hog and scanty.

*Horny appendages*—Ergot patches of thin horn on all four limbs; chestnuts 3 in. by 2 in., thin horny patches; no castors.

*Colour*—Pale isabella or sandy above with slight but distinct rufescent tinge (Jerdon). Lower half of muzzle, lower part of neck, along each side of dorsal stripe along back, under belly, back of fore limbs, round the front and outside of the elbows, front of the hind limbs to the hock, and back of the limbs to the hamstring white. (Mare in Jodhpur Collection, 1887.)

Female in Victoria Gardens.—Muzzle and lower parts of body and limbs white; slight zebra marks, both knees; large chestnut horny patches; general colour rufous or isabella; tip of ears and outer side of hind margin brown; mane upright, brown, decreases from poll backwards; dorsal stripe zigzag between withers, very wide to croup, along back and loins, narrowing on tail, and does not run to tuft, but terminates about half way.

*Markings*—Dorsal stripe chocolate brown: very broad at commencement of croup, grows gradually narrow towards the mane, runs to tail tuft (Mare in Jodhpur Collection, 1887). Colour extends slightly down outside of shoulder; sometimes double cross stripe (Jerdon). Zebra marks on hocks posteriorly in female, zigzag markings from stifle to below hock on outer side of limbs and from outside of elbow to below knee in fore limb in male (Jodhpore Collection). Limbs faintly barred, now and then strongly so; narrow dark ring over hoof (Jerdon). Zebra marks on shoulder in adult and still more in foal (Walker).

*Size*—11 to 12 hands.

*Habits*—Shy, difficult to approach; of great speed; lives in troops each under a leader, on the plains in winter and mountains in summer. Bikaner herd of about 150; foaling in June, July, and August.

*Voice*—"A Shrieking bray" (Blyth), or like that of a mule (Tytler).

*Ears*—Sandy externally, white internally, with black tip and outer border; longish (Jerdon). Certainly brown at tips in Jodhpur

specimens, rounded at tips, smaller in proportion than those of domesticated ass.

*Head*—Heavy, but well formed ; neck short ; croup higher than withers, which are scarcely developed.

*Remarks*—“ Nine-tenths are actually gelt by the teeth of the jealous sire the moment they are foaled” (Harris).\* This animal is sometimes captured alive, for sales to chiefs, by means of relays of horses, which run it down. It requires an exceptionally good horse when mounted, to fairly excel the wild ass in pace and endurance. Sometimes he is captured by means of falcons or is shot ; the flesh is esteemed a great luxury. The hide is converted into the common Turkish shagreen. The young are sometimes trained, but adults become unruly. The onager is found in Cutch, Guzerat, Jeysalmir, Bikaner, Sind, Beloochistan, Persia, and Turkestan ; its range is to Deesa south, to 75° long. E., and to lat. 48° N. in Turkestan, west it extends as far as the road running from Teheran to Shiraz. I have a suspicion that not so very long ago the onager extended into the Deccan. Specifically identical with *As. vulgaris*, either progenitor or descendant (Cobbold). [Alayar Khan of Mahmudabad sent out into the desert for a wild ass. One was shot and brought in. It was as big as a small mule, yellow dun with dorsal stripe. . . . Ghorkur was seen in the desert towards Abiverd. The Khoords describe a good horse by saying he can ride down a wild ass. On the Attrek in the broad open vales wild asses (Roostum said) are to be found in immense numbers. Between Sanghos and Jahjerm near the brackish streams about four miles off the road numberless fresh tracks, as though the whole herd followed in Indian file, were seen. The ground was very rough and broken, though quite rideable, rather heavy going, being covered with a salt sandy crust through which the horse's feet sank at each stride \* \* \* Came suddenly on a herd of fourteen. The horses ( after a march ) were done up in trying to chase them down ( Col. Valentine Baker)].

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4. *EQUUS HEMIPPUS* (Is. Geof. St. Hilaire) ; *As. indicus* (Scalater) ; Hemippe : Syrian wild ass ; wild ass of Scripture.

*Voice*—More like a bray than that of onager (Blyth). St. Hilaire also notices this difference.

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\* This is, of course, a “ traveller's yarn.”—J.H. S.

*Ears*—Shorter than onager (Blyth).

*Head*—Smaller than onager (Blyth).

*Remarks*—Found in Syria, Mesopotamia, and North Africa.

5. *EQUUS TÆNIOPUS* (Hengl.) *As. tæniopus*; Abyssinian wild ass.

*Characters*—As of *Eq. onager*; stripes frequent on hind legs.

*Habitat*—Abyssinia and the desert plains between the Nile and the Red Sea.

*Horny appendages*—Hoofs as broad as those of a horse of fifteen hands in height (Baker); remarkably large, wide, and firm.

*Colour*—A reddish cream tinged with the shade most prevalent of the ground it inhabits (Sir S. Baker).

*Markings*—Cross bands on legs and shoulder stripes.

*Size*—13·3 to 14 hands, of a fine male (Baker).

Rayment shows that a small breed of donkeys in Muscat is remarkable for hardihood, endurance, and viciousness, qualities to an extent due to constant crossing with the wild stallion from the Assyrian desert captured for the purpose (probably the hemippe).

*Remarks*—Supposed to be the nearest feral representative of the domestic ass. “The perfection of activity and courage, and has a high-bred tone in the deportment, a high actioned step when it trots freely over the rocks and sand, with the speed of the horse when it gallops over the boundless desert.” (Baker.)

6. *EQUUS HEMIIONUS* (Pallas): Kiang; Tschiketai; Thibetan wild ass; kulan; the wild horse (Cunningham); djang (Tangutans).

*Mane and tail*—Mane dun (Moorcroft).

*Colour*—Upper parts dull ruddy brown or chestnut rufous hue approaching bay, especially about the head; distinctly darker at the flanks, where it abruptly contrasts with the white on the belly. Coat varies according to season, smooth and rufous in warm weather; legs a pale straw. Darker in colour than onager.

*Markings*—Dorsal stripe black; absent, obscure or well developed, extending to tail tuft, broad on croup. No zebra stripes either in adult or foal (Walker). Shoulder stripe sometimes distinct, often but faint or rudimentary; generally absent.

*Size*—Fourteen hands.

*Habits*—Wary, swift, difficult to approach, inquisitive, lives in small troops or herds in Thibet and Central Asia. Moorcroft saw

it in Ladak, and his pundit, Izzat Ullah, mentions wild asses in Khoten; extends into China eastward. Lives on plateau at elevation of 15,000 to 16,000 feet above sea level. Fly at a trot, stop, look back. Prejevalsky considers it the most remarkable animal of the Kokonor Steppes. It is found also in Tsaidam and North Thibet. Often seen grazing in company with mountain sheep. Found in troops ten to fifty strong, or in herds of several hundreds, in Kokonor (Prejevalsky). The young are born in May, but many die before maturity (Prejevalsky).

*Voice*—Has given rise to much discussion as to whether he neighs or brays. Prejevalsky heard his voice twice, once when a stallion was calling back mares, the second time when two were fighting. It is "a loud harsh neigh, repeated at short intervals, combined with a bray."

*Ears*—Moderate in length.

*Head*—Large and ugly; forehead convex between eyes; centre of face narrow and keeled on sides.

*Remarks*—In size and external appearance closely resembles a mule (Prejevalsky). Is the most equine of wild asses, and differs but little from the Terpan or wild horse of Central Asia, for which it is constantly mistaken. Is also, especially by the Tartars, confused with onager, both being called kulan. Gray discusses the position of the infra-orbital foramen in the kiang and onager, also certain differences in the skulls. I am inclined to consider these differences as simply due to age not to specific influences. A comparative study of the skulls (and indeed of the skeletons in general) of the Equidæ is much needed. When young they will become so tame as to be led about like a horse, and will follow horses almost everywhere (Charlton). Colonel Smith describes as the Yo-to-tze also as *As. equuleus vel Hippargus*, an animal seen alive in a livery stable near Park Lane, London, said to have been brought from the Chinese frontier N.-E. of Calcutta. It had shoulder bands black, three or four cross streaks (black) on knees and hocks; well defined black dorsal stripe to centre of tail; tip of ears, mane, and long hairs of tail black. Gray thinks it may have been a cross between the kiang and the domestic ass. The natives consider kiang flesh a great delicacy and stalk the animals to shoot them after drinking. They are very plucky when hit and hard to bring down. They get very fat in autumn; when frightened they run down the wind.

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7. *EQUUS QUAGGA* (Linnæus): *As. quagga*; "Female zebra" (Edwardes); *Hippotigris quagga* (H. Smith); *Hipp isabellinus* (H. Smith); *Ane isabelle* (Le Vaillant). The quagga is the bravest of equines, and so was occasionally domesticated by the Boers to be turned out with the horses at night to protect the latter from predatory beasts on which the quagga springs, beats them to the ground with forehoofs, and tramples them to death (Nott).

*Mane and tail*—Hair extends nearer to base of tail than in other equines, except horses (Lesson). Hog mane, banded alternately brown and white; tail white.

*Horny appendages*—No castors—hoofs slightly concave beneath and broader than in zebra. "A foot which might serve as a model to a veterinary student" (Harris).

*Colour*—Upper parts of hide rufous brown; lower parts of body white; legs white; stripes on forehead and temples longitudinal, and on cheeks with narrow transversal stripes forming lineal triangular figures between eyes and mouth.

*Markings*—Stripes to centre of shoulder and back; stripes not so deep in colour as those of zebra. Muzzle black. Dorsal line dark and broad, widening over croup.

*Size*—13 to 13·2 hands, about 6 inches longer than that of true zebra (Nott): (8ft. 6in. long).

*Habits*—Courageous, sociable, peaceable, found in immense herds in the open plains, travels in long files of many hundreds, parallel with caravans (Harris). Is not seen north of the Vaal, and is vanishing before civilization. Seems remarkably fond of the brindled gnu and ostrich, which graze with it, but does not mix with its own more elegant congeners (Harris). Form compact, body round, limbs robust, clean, and sinewy, with pace low and laboured.

*Voice*—Like the bark of a dog, a shrill barking neigh, which its name well imitates.

*Ears*—Equine. Flesh disgustingly oily and yellow.

*Head and neck*—Very large, which increases the apparent size of the animal.

*Remarks*—Buckley considers that now the Burchell's zebra is generally called the quagga, and Harris' quagga must have become extinct. The zebras of all three kinds have been shot extensively, because their hide forms good connecting bands for machinery. Less fierce in disposition than the zebras and "of the whole family

unquestionably the species that is best calculated for domestication" (Nott).

8. *EQUUS BURCHELLII* (Bennett); *Hippotigris Burchellii* (Smith); *As. Burchellii* (Gray); *Eq. zebroides* (Lesson); *Eq. montanus* (?) (Cuvier); Bonti Quagga (Cape Colonist); Dauw; Peechey or Peet-sey (of Bechuanas): "Is the Quagga *par excellence* of South African sportsmen" (Nott).

*Mane and tail*—Tail white, equine; mane hog, banded black and white; mane 5 in. high.

*Horny appendages*—Hoof soles slightly concave, rather broad.

*Colour and markings*—Muzzle black; head and upper parts of body and upper parts of legs sienna-brown, and with broad dark brown bands not uniting above with dorsal line, which widens towards the croup. Lower parts of body and of limbs and inside of limbs white; bands less numerous than those of zebra. The degree and extent of colouring varies much (Buckley).

*Size*— $13\frac{1}{2}$  hands. 8ft. 6in. from nose to point of tail (Harris).

*Habits*—Seems very fond of the brindled gnu; found in herds of 80 to 100 (Harris). Buckley generally saw it, at least in the bush, in parties of 8 to 10, his largest troop being about 40. Found on the plains north of the Orange River, but migrates periodically in accordance with exigencies of food supply. Extends into Abyssinia and Congo. Is fierce, strong, fleet, and beautiful (Harris). Stout in build, admits of being tamed to a certain extent with considerable facility, and occasionally a half domesticated specimen is exposed for sale in Cape Town with a rider on its back, but even in the most tractable state to which it has yet been reduced it is regarded as wicked, treacherous, obstinate, and fickle (H. Smith). The late Lord Derby had several in his collection at Knowsley Park, and was very successful in rearing foals (Nott). Figure sturdy and graceful; carcase round; limbs clean and muscular, less robust than those of the quagga.

*Voice*—A shrill abrupt neigh, which may be likened to the barking of a dog, as heard by a passer-by from the interior of a house (Harris).

*Ears*—Equine.

*Remarks*—Has four mammæ. Skin extremely valuable; flesh much appreciated by natives, but its dark colour and yellow fat render it anything but tempting to most white men (Nott).



9. *EQUUS ZEBRA* (Linnæus) ; Witte-paarde (Dutch Colonists) ; *Hippotigris zebra v. campestris* (Smith) ; *Asinus zebra* (Gray) ; *Equus montanus* (Burchellii) ; Daw (or true zebra) of the Colonists ; *Hipp. antiquorum* (H. Smith). Louis Figuier states that the Persians used to slaughter zebras (probably onagers) at their religious festivals, and kept a stock of them for the purpose on a small island in the Red Sea.

*Mane and tail*—End of tail a black tuft ; remainder of tail white. Mane bushy, hog, and banded.

*Horny appendages*—Hoofs narrow, with hollow soles ; no castors.

*Colour*—Creamy white, inside of legs and belly white ; muzzle reddish or tan.

*Markings*—Striped of black colour over the body, head, and limbs, the bands being narrow or wide, black, and sinuous, and uniting with the longitudinal dorsal line. Those of body nearly vertical, those of limbs horizontal and closer together than those on the body.

*Size*—Under thirteen hands, exceeds eight feet in extreme length.

*Habitat*—Inhabits the hilly region of South Africa. Harris gives his range from Abyssinia to the Cape. The Dutch farmers use to catch foals and export them “chiefly to Mauritius, where it is said they were often whimsically trained to harness.” A Queen of Portugal used to drive a team of zebras, and Rarey tamed one. Upwards of 100 in a troop ; is shy, fierce, obstinate, nearly untameable, timid, supposed to be rapidly becoming extinct.

*Voice*—Subdued neighs like the gasps of a dying man (Anderson).

*Ears*—Long and widely opened.

*Head*—Light.

*Remarks*—Flesh coarse, oily, unpalatable ; two mammæ. There is a small amount of written testimony to the occurrence of zebras or onagers in the mountains of Spain between the 10th and 13th centuries, probably imports from West Africa. They were widely dispersed from Galicia to Estremadura and Andalusia.

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We are now in a position to enter more into detail with regard to the general characters of the Equidæ. We find that all present a mane or growth of long hair at the upper margin of the neck, which varies in length, colour, and arrangement. It is most highly de-

veloped in the male, and it is decidedly ornamental, whether as the long flowing manelocks of the horse or the smart hogged appendage seen in the other forms. It may be uniform in colour, is generally darker than the rest of the body, or banded in accordance with the striped condition of the neck; the bands may be black or brown; long hairs also grow on the tail, rendering it a beautiful appendage and useful fly-flapper. Here also the horse has the advantage, the hair being long and flowing, covering the whole of the tip and outer part of the stump. Burchell's zebra and the quagga have the equine form of tail, but the capillary arrangement is less striking. The other equines resemble the ass, in that the long hairs are developed on the end of the stump as a tail tuft resembling that seen in some ruminants. In the zebra the tip of the tail is black and the rest white. As a rule, the organ is darker in colour than the rest of the body.

Of *horny appendages*, the *hoofs* vary in broadness and concavity of sole, a point which seems to be much determined by, and to indicate, the habit of the animal. Thus mountainous and sure-footed equines have mule feet, *i.e.*, hoofs upright, narrow, and hollow-soled, as seen in the ass and zebra. *Castors* are absent in all forms except caballus, but we have no distinct evidence as to whether they are present or absent in the kiang it seems they are sometimes not found in true horses. On the other hand, the *chestnuts* and *ergots* seem present in all species; in the horse they are hard and strong, in the onager they are wide and soft horny patches. Ergots may be absent, certainly in high-bred horses.

The *colour* varies from black to white, no rule can be given except that the wild forms tend to sandy or rufous tint with lighter shades of the lower parts of the body and insides of the limbs, also darker "points," *i.e.*, muzzle, mane, tail, and legs. Domestication tends to great variety in colour.

*Markings* attain their highest development in the zebra as (a) dorsal line from mane to tail of dark colour (black or brown); (b) vertical body lines, of which the most persistent are those on the centre of the shoulders, which are wide and forked at their free ends, others are parallel with the branches of the forks; and (c) the horizontal bands of the limbs. These markings reappear more or less in all forms, the most frequent and constant being the dorsal stripe or list, found as a characteristic even in some breeds of horses. Not much less frequent are shoulder stripes, and even the zebra

marks on knees and hocks reappear frequently in horses. Darwin considers that if grey or red brown asses had been steadily selected and bred from, the shoulder stripe would have been as generally and completely lost as in the horse. These markings are best seen in the male; often when present in the young they disappear in adults.

*Size* shows a neat gradation from the wretched little 7-hand donkey of the Maharattas up to the 16-hand dray horse; it varies enormously with domestication, but among the equines in the wild state seems to range from 11 hands or 12 hands (onager and zebra) through 13 hands (quagga), and  $13\frac{1}{2}$  hands (peechey) to 14 hands in the kiang, and still more in the wild horse.

*Habits*—All these wild equines are strong, hardy, swift-footed, courageous, but shy, and curious in the extreme. They vary much in tameability, but have all been more or less brought under control, and they exhibit as much variety in character as we see in domestic horses. The liking of these animals for, and their ready association with, other species is remarkable. All seem to be fond of the gnu, and they do not object to the presence among them of so different a creature as the ostrich. The gregarious instinct seems stronger in some forms, such as the zebra, than in others like the kiang, but the size of the troops is probably determined much by the amount of pasture available and the freedom from disturbance by man. The same influences determine the range, both African and Asiatic forms are retreating before the advancing steps of civilization, and they all seem to frequent the mountains in hot weather and the plains in cold, according to the amount of pasturage available. The kiang and zebra are most fond of mountains, the onager inhabits hills and sandy deserts, and the peechey grassy plains. These differences seem to be determined by local circumstances: in fact, the equine adapts himself to the conditions of his surroundings.

The *voice* ranges from a neigh, so familiar in the horse, to a bray, equally familiar in the ass. The intervening sounds seem to vary as much as the tuneful notes of transport mules when the trumpet sounds "feed."

The *ears* vary much in relative development as regards length, sharpness of tip, and fineness, exhibiting every gradation between the familiar auricle of the ass and the neat delicate corresponding part in the horse.

Our information as to osteological characters is very scanty, but it suffices to show us that the differences are simply those of

measurement, *i.e.*, such as we look for in comparing the skeleton of a man of one race with that of another.

As regards *shape* there is a general tendency to largeness of the muzzle, backward setting of the eyes, shortness in the rein, and imperfect setting on of the head. Neck short and stout, shoulder upright, forearms and thighs moderate in length, limbs small below the knee and hock, back short, barrel rounded and large, quarters rounded, tail set on low, goose-rump. These general characters are not those best adapted to man's requirements from horses, but they are suited to enable the unbridled and unmounted equine to be swift in the extreme, sure-footed, and capable of remarkable endurance. It is not only in respect to less suitability for man's requirements than the horse of civilization that inferences from the study of the asses and zebras agree with those which, as on a previous occasion we have seen, may be drawn from a study of wild horses. The remarks made about wild horses, as regards uses, methods of capture, geological range in time, also the physical characters of the habitat may be extended to the true feral Equidæ.

Traits of temper, character, inclinations, and habits are remarkably uniform in animals of the horse tribe. In the study of the ass we might almost go over the same ground as that already traversed in investigation of the horse; the uncertainty of origin, the considerable range of variation, some remarkable limits in geographical range under natural influences, and extension of spread under human influences, might be commented on. Writers on natural history lay stress on the fact that the ass never really goes wild as the horse is apt to do, and the zebras never really become domesticated; but I doubt whether the former view could be thoroughly established, and I have already had occasion to direct attention to the fact that the fierceness and untameability of the zebras is somewhat overrated.

Previously we have drawn from such evidence as was to hand in the form of geological remains, early art, testimony afforded by horses in the present day, and otherwise, a sketch of what we considered to be the primitive horse, and concluded that he must have been remarkably like the wild asses and zebras of the present day. One cannot help going still further backwards in time and surmising that there was a period when the equines of the world were only of one kind, the ancestor of the horses, asses, and zebras of to-day. Supposing this to have been the

case, we may surmise that the ancestor in question was a sort of dun brown in colour with hog mane, dorsal stripe, and probably asinine tail. The lower part of his body and the inner sides of his limbs were lighter in colour than the general ground of the skin, he probably had zebra marks and castors; was rather small in size (say 12 hands), had large head and ears, stout and rather short limbs narrowish mule feet. His habits were those of the wild equines in the present day, but his range was much more extensive, comprising Europe, Asia, Africa, and America. In time he became extinct in America after undergoing development in several directions probably; in Central Asia he developed caballine characters such as are seen in the kiang and terpan, and, as they proved useful to man, were the cause of subjection of this branch of the family to man and its enormous modification by art. In Arshia and South-East Asia the asinine characters found favourable influences, and some of them, as seen in the tæniope and onager, also proved useful to man, who brought artificial selection to bear in such a way that the domesticated ass of the present day differs remarkably from the onager. Finally, in East Africa to the extreme south, the hippotigrine characteristics seem to have found scope for development. Man found this branch uncontrollable, and it probably affords us an example of the least changed descendant of *Equus primigenius*. It is generally now admitted that the theory of descent can be accepted as a good working hypothesis. It certainly receives support from study of the *Equidæ* and, on the other hand, would lead us to interesting conclusions with regard to them. It would explain to us where the stripes of the zebra come from, and why in South Africa the equines differ in appearance from those of Asia and North Africa. Taking it into consideration, we can to an extent understand that the inborn tendency of the horses of all kinds to develop donkey stripes and zebra marks, a tendency most often manifested in the foal of non-striped races which in the South African forms, becomes exaggerated, so that we are led through the quagga and Burchell's zebra to the true zebras, which exhibit striation to the full extent. The theory of descent as regards zebras is much more satisfactory than that of mimicry. We must consider it much more probable that equines spread to South Africa and gradually become modified by surroundings than that in the South African fauna there were developed animals showing full equine characters but differing from the horses and asses in being

more striped. Geological and historical evidences are in favour of the former view, and we find transitional specimens between the different kinds of zebra, which lead to the belief that change is still going on in the present day. It is interesting to note how the quagga inclines to equine characters and the other two forms somewhat to those of the wild asses of Cutch and Thibet. This would seem to indicate a tendency of the zebras to branch off into new forms, as the original stock did, exhibiting equine, asinine, and zebraic characters.

To conclude : Study of the feral equines enables us to determine what are the essential characters of the group and to contrast them with those found in the horse and the common ass warped by domestication. It teaches us what are the natural conditions of the horse, from which we may draw useful lessons as to preservation of his health. It places us in a position to appreciate the enormous influence exerted by man on the horse and ass. Some valuable general conclusions on artificial and natural selection, on geographical and geological range, and on other important problems of natural history can be derived from the study; and, finally, to the sportsman and even to the student of economy our subject should prove interesting and instructive. To the zealous student the group of Equidæ presents many problems to be solved and much error and mawkish sentiment to be estimated at its true value in the search for *truth*.

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#### THE CONDITIONS FOR THE DISTRIBUTION OF PLANTS AND THE MEANS BY WHICH IT IS PERFORMED, WITH SPECIAL REGARD TO INDIAN SPECIES.

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THOUGH it would be very tempting to give you a demonstration of the vast number of picturesque features that are caused by the natural association of plants, or to point out for you the striking peculiarities of vegetation in various climates and regions, or, in short, to describe the multifarious aspects of geographical distribution of plants, I shall resist the temptation, and confine my remarks to some of the causes on which local floræ depend.

The more important of these causes are—the conditions for the distribution of plants and the means of distribution. (Besides these, a very important item is the comparative power of plants of holding their own in the struggle for existence, a subject which still requires the most careful study, and which I am not prepared to deal with here.) The conditions for distribution of plants are chiefly these, *viz.*, the climate, the adaptation of plants for climatic influences, the natural quality of the soil, and the necessity of fertilisation for plants. You are all aware of the very distinct features of vegetation, as represented in different regions, countries, or even localities of the same province. You will have noticed that the vegetation of the seashore is very different from that represented further inland; that the plants of our hills are to a great extent of other species than those occurring in the plains, or that almost every different locality has its peculiar flora. When we ask for the reason of this, the reply will often be found in the various natural conditions of the said locality, but what I especially wish to point out to you is, that a little closer observation of the plants themselves will prove that peculiarities in their structure or apparently casual appendages make them particularly adapted for the natural conditions presented by the locality, and that they are of the utmost importance with regard to distribution of the plants. For the observation of this fact, as for so many important discoveries in regard to natural objects, we are specially indebted to your great countryman, Charles Darwin, who pointed out the way, which has been followed by several botanists, among whom I may mention Dr. Hermann Müller (Lippstadt), Dr. Friedrich Hildebrand (Leipsic), Dr. A. Kerner (Vienna), and Professor Otto Kunze (Leipsic), as authorities for many of the views expressed in my paper. The field is, however, so vast, that the subject will probably never be thoroughly exhausted. It is particularly interesting, not only in affording ample evidence in support of the much disputed theories of Darwin, but also in explaining the necessity of almost every organ of plant life. Of the natural conditions for distribution of plants none is more decisive than the climate. The local range of temperature is in many instances an absolute necessity for the growth of plants, and by this circumstance the limits of distribution for every species of plants are generally fixed. As to the exact range of temperature necessary for the individual species, the requirements greatly differ, but it may be regarded as certain, that

for every species there is a maximum and minimum of heat, which the plant will endure without harm, while an excess will kill the plant or at least prevent its distribution. It is a well-known fact that the faintest touch of frost is sure to destroy a *Dahlia* or a *Heliotrope*, while *Chrysanthemums*, *Pansies*, and *Daisies* continue to flower even in several degrees of frost, also that many seeds of plants from colder climates, as of most European weeds do not even germinate in a tropical climate, and that many annuals only grow satisfactorily here in the cold season. On the other hand, most Indian plants, when cultivated in Europe, require a certain amount of artificial heat. Some very interesting experiments and observations have been made with the grape-vine, I believe, by a German botanist, who has succeeded in proving that this plant everywhere and under different natural conditions, requires the same total amount of degrees of heat for performing its growth and producing good fruit, and it may be regarded as certain that the same total amount of sunlight is necessary to produce the full chemical qualities of the grape, as colour, flavour, and sweetness.

The limits of distribution for plants of the same species with regard to influence of temperature are sometimes very extensive. The *rose*, for instance, grows to perfection as far north as Sweden up to 60°, N.L., though there certainly requiring protection in winter, and is at the same time satisfactorily cultivated here in Bombay. This fact may, however, partly be attributed to cultivation and to properties thereby acquired. But even among wild plants, several species with an equally large range of distribution, occur, as *Solanum nigrum*, which is a very troublesome weed all over Europe, and not uncommon here in India, though perhaps originally introduced. Other plants have but a very limited range of distribution, as the Mangosteen, *Garcinia mangostana*, which is truly wild in the Malay Peninsula, but even in Bombay, not 20° farther North, is a very tender plant, though the same genus is represented by other species as *Garcinia indica*, the kokum, and *Garcinia xanthochymus*, which both yield pleasant acid fruits.

A similar demonstration of these facts is pointed out in the Hon'ble Mr. Justice Birdwood's excellent Catalogue of the Flora of Matheran and Mahabaleshwar, by comparing the vegetation of the ascents with that of the top of the hills, and which I need not further explain.

By close observation of the plants of the same species or genus, we shall find that they greatly vary even within the same range of



temperature according to locality, and that this variation is chiefly due to adaptations for excesses of temperature or to more or less developed means of protection against climatic influences. Here we never experience any *severe cold*, and I need not dwell upon the means by which plants are protected against the injurious effects of a low temperature, but shall only mention that these are often similar to those intended for protection against heat; in many cases, however, the medium of protection is the snow, which fact explains the tenderness of many Alpine plants, when cultivated in temperate regions. The heat of our climate is at times very trying, not only for man but also for plants, and most of our plants are therefore provided with means of protection against the heat and aridity of the long dry season. The Indian tropical flora is in comparison to that of more temperate climates singularly rich in arboreous species, a fact that may be accounted for by the greater resistance of a woody structure to excesses of heat. I cannot here deal with the structure of the wood and the stem of a plant, but must restrict my remarks to point out that it is especially adapted to protect the plants against climatic exigencies, and that in this respect perhaps the *cork*, the *liber* or bast, and the *bark* are very important parts of the wood. It is therefore not surprising to find that both *cork* and *liber* are frequently very conspicuous in Indian trees. I have in fact only seen very few where the cork is not clearly visible, if not otherwise, then by lenticels on the young shoots, especially when these are glabrous. It is also a well known fact that many Indian trees are rich in fibre, which is generally the produce of a well developed liber.

The next object for observation is the *pubescence* or *hairiness* of plants, which though apparently insignificant, is of the utmost importance for protecting plants. As far as I have been able to judge from observation of plants that have as yet come under my notice, I think it is a fact that most herbaceous plants, when completing their growth during the rains, are more or less glabrous; while those species, which continue their growth during the dry season, are generally more or less hairy. You will notice this by observing the weeds of this season. As an example, I shall mention a few of the numerous species of the genus *Blumea*, which is singularly interesting also in other respects. The most common species, *Blumea membranacea muralis*, which grows on old walls and on the inside of wells, has almost completed its growth when the dry

season sets in, is quite glabrous below, only glandular-pubescent on the upper parts, and quite scentless. The common *Blumea Wightiana* is distinguished by its dense, almost velvety pubescence, and a most pleasant mint-like fragrance; it grows with its near ally, *Blumea* (now *Laggera*) *aurita* on rubbish-heaps, and as a weed of the cold season in gardens and fields. The last-mentioned species is perhaps less hairy, but has a much stronger turpentine-like fragrance, as also the yellow flowered *Blumea lacera*, common on roadsides. Finally, we have the mountain forms, *Blumea glomerata* and *Blumea Malcolmii*, both of which are densely woolly, silvery white and strongly scented.

But also within the same species the degree of pubescence is very variable according to season of growth and locality. One of our most common weeds, *Gynandropsis pentaphylla*, is generally nearly smooth in the rains, but at this time of the year always more or less hairy, and *Hydrocotyle rotundifolia* is glabrous in shady positions, but hairy when exposed to the sun.

Similar observations with regard to other plants have led to a correct conception of the importance of hairs for plants. The protection they afford is manifold, chiefly against excessive heat; and I shall only mention a few of the more important capacities of the hairs. When closely set they shade the tender parts of plants against the burning rays of the sun, when very dense and white they reflect the heat, by force of capillarity they always absorb even the smallest quantity of moisture from the air, and finally they serve the plants by retaining the dew.

In citing the various species of *Blumea*, I laid stress on their fragrance. I did so, as this peculiarity is also highly protective against heat. You may all have experienced the cooling and refreshing effects of applying perfume to the skin, a circumstance, which I need not hardly tell you is caused by the rapid evaporation of all essential oils. Now the fragrance of plants is due to exactly the same cause, evaporation of essential oils, and we may therefore conclude that such plants are constantly cooled and refreshed, in order better to resist the heat. But besides, Chemistry teaches us that the result of this mechanical action is the formation of resinous substances, which are probably deposited on the surface of plants and thus further check the evaporation, chiefly during the hottest and driest parts of the day. The viscosity of many aromatic plants tends to prove this view.

Most Indian trees and shrubs have a glossy green foliage, *e.g.*, the leaves are coriaceous or have a strong *cuticula* (the outer coat of the epidermis.) The protection of the mesophyll, or the inner parts of the leaves, is not only due to the close texture of the cuticula, but also to its glossy nature, by which quality the rays of light and heat are reflected. Trees and shrubs with tender foliage as a rule shed their leaves in the dry season, unless these are hairy or protected by other means. Among these I shall mention the periodical movements of leaves, especially the regular folding up of the leaves at nightfall, as we meet with in many *Acacia*, *Mimosa*, *Albizzia*, *Pithecolobium*, and which is frequently called the sleep of plants.\* This peculiar phenomenon is probably a very necessary provision which, though caused by the absence of light, is actually intended for exposing the underside of the leaflets to the full benefit of absorbing moisture during the night. Such leaves have as a rule channelled petioles, which are probably meant for retaining the dew.

The leaves of other plants, as of the curious forms of *Cactaceous* plants and leafless *Euphorbias*, are frequently transformed into spines or scales as in *Opuntia Dillenii* and *Euphorbia Tirucalli*, in order to reduce their evaporation and to enable the plants to withstand heat and drought. All *succulent* plants, of which the common *Aloe*, so frequently seen suspended in front of shops in the bazar, is a good example, are similarly well adapted to flourish in the driest localities.

*Tubers*, *bulbs* or *rhizomes*, which in India are represented by numerous species of *Araceæ*, *Zingiberaceæ*, *Amaryllidaceæ*, *Ferns*, &c., are other structures that preserve the plants during the dry season, when their annual top dies away. The *pseudo-bulbs*, *fleshy stems* and *quasi parasitic roots* of *Orchids* are similar contrivances.

Finally the *milky juice* of plants, so characteristic in the genus *Euphorbia*, in many *Ficus*, and several *Asclepiads*, the *secretions* of *wax* or other vegetable fats, and the *resinous substances* found on many plants, may also be regarded as protection against heat, but more probably as an adaptation for sudden changes of temperature.

Next to severe cold, excessive heat and drought, the *wind* is the most active of climate agencies. Though in many respects very

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\* Since I wrote this, I have observed that the leaves of *Cassia marginata* expose their upper surfaces during the night, but in this case the under side is very hairy.

destructive to vegetation, the wind is nevertheless a most necessary assistant for the distribution of plants, which I shall presently show. The fatal effect of strong winds or of constant monsoon winds is well illustrated in Bombay, and the trees at Malabar-Point form one of the most interesting sights of this city. We see there how the Nandruk-trees only grow to a few feet above the ground, and then are forced to continue their growth in a horizontal direction, or how the trunk of a common date-palm in the struggle for existence has assumed a shape which may be almost compared to that of a winding serpent. It is a well known fact that the more exposed points of elevated plateaus or mountains are frequently destitute of trees, or that the species found in such localities by their peculiar structure are singularly adapted to resist the force of the wind, while ravines and other sheltered places are often conspicuous by the richness of their vegetation. It is also a common experience, that many of the beautiful Indian trees will not grow when exposed to the full force of the monsoon, though this fact is not always due to the force of the wind only, but more frequently to the numerous particles of salt that are brought from the sea by the wind. On the other hand, most palms, as the *Cocoanut palm* and common *Date palm*, abound and flourish in the immediate neighbourhood of the sea. It has even been said that the sea breeze is absolutely necessary for many palms. This statement is however amply contradicted by the successful culture of most palms in European hot-houses; the truth is probably that dry land winds prove dangerous to their growth.

The means by which trees are protected against the fatal effects of wind, which often seriously affect their distribution, are either sheltered localities or peculiar structures of the root, stem, or crown of the tree. Of sheltered localities I have already mentioned ravines, and may further add dense forests and sheltered plains, but occasionally plants of the same species associate in large clumps, and thereby mutually protect each other. Among the structures of trees, with regard to protection, may be mentioned *deep growing tapering roots*, a frequent occurrence in arboreous plants; a *solid or flexible trunk*, as we find in most palms, to which is sometimes added a tendency to grow against the wind, as in the *Cocoanut palm*; peculiar swelling of the stem, as in the West Indian *Oreodoxa regia*; or a *continual layer of woody leaf scars*, as in *Phoenix sylvestris*, the common date palm. Other trees have a very large and densely-leaved crown, as

the *wild mango*, or are strengthened by rooting pillars or secondary stems, formed by aerial roots, as the *Banyan*, *Pandanus*, and *Rhizophora*. By all these structures the individual strength of the tree is enhanced and its resisting power increased, while other trees are so constructed as to reduce the extent of the resisting surface. In a few Indian trees, as in *Eriodendron anfractuosum*, one of our silk-cotton trees, and in *Terminália catappa*, the "Badam," all the branches are horizontally arranged in regular whorls, between which there is ample room for the wind to pass. Similar structures are found in a great many *Coniferæ*, noticeably in *Araucarias*, where also the small linear or scaly leaves tend to expose a very small surface to the action of the wind. Such a limited development of the leaves is a common feature in many plants, as in most Australian Leguminous plants, in *Casuarinas*, *Tamarix*, and many others. Very finely divided, pinnate or bipinnate leaves, as in *Poinciana*, *Mimosa*, *Albizzia*, &c., do perhaps render similar services to the plants, which seems to be the more necessary as the wood of such trees is frequently very brittle.

The next and last of climatic agencies of which I shall speak are rain, humidity, and moisture. Of these the local annual rainfall is chiefly important for distribution of plants, in fixing certain limits, but also humidity of the atmosphere and moisture of the ground are important items. A certain quantity of each of these is necessary for all plants; but it is and will always be extremely difficult to ascertain the exact requirements of the different species, and we can only by experience learn that one requires next to no supply of water or damp air, while another requires to be constantly soaked. How plants are protected against a minimum of rain or moisture has been mentioned in connection with their protection against heat, and it only remains to be seen how they are guarded against excesses. In this respect may be mentioned local shelter, woody structure, *bark*, *cuticula* of the leaves, *secretions of wax* and fatty substances and a layer of condensed air, that frequently surrounds the leaves of many plants and prevents their wetting, as in the fronds of Maidenhair-ferns, which when dipped in water look as if they were silvered and remain perfectly dry. The parts of plants most susceptible to the effects of rain and moisture are the flowers or at least the sexual organs, which are in most cases more or less protected. Their means of protection are however too numerous to be recorded here, and I shall only mention a very few, as the frequent nodding position of the flower, the closing of the petals at night

and in rainy weather, and the season of flowering. Other means are at the same time intended for protection against the attacks of animals, birds, and insects, or serve as adaptations for attracting and aiding insects in performing fertilisation, etc., a subject on which several books have been written, and which is far too comprehensive to be more than hinted at here.

In connection with this, I may mention that plants are by numerous means protected against the attacks of animals, birds, and insects; but these being of lesser importance for the distribution of plants, may be omitted here.

By a closer observation of the facts, of which I have pointed out a few of the most striking, I think we will arrive at the following conclusion:—"That the distribution of plants greatly depends upon their capability of adapting themselves to a particular climate, upon their means of protection, and upon their adoption of new habits under altered circumstances."

The next condition for the distribution of plants is the natural quality of the soil, which is in a few cases of importance. I beg you to remark, that I say a few cases, because the popular conception, or rather deception, is that the quality of the soil is almost everything for the successful growth of plants. With regard to a few plants possessing a particular quality of extracting prepared food from the ground, it is no doubt true, but the rule is that only the physical condition and not the chemical composition of the soil is of importance, as it has been amply proved that plants derive by far the greatest amount of nourishment from the air, and that the few mineral substances that are actually necessary for the growth of plants are nearly always present in sufficient quantities in any kind of soil. We may therefore conclude that the quality of the soil is very insignificant with regard to the distribution of plants, and when at all of importance, may be partly attributed to climatic agencies.

It is, however, not sufficient that climate and soil offer favourable conditions for the growth of plants; their distribution will also depend upon the perfect development of their flowers and fruits; or upon a satisfactorily performed *fertilisation*, unless the plants possess other means of distribution than seeds. Fertilisation is not always the result of a favourable climate, but is frequently caused by the presence of a particular insect or plant. It is well known that the *Vanilla* grows luxuriantly and flowers freely in India, but also that it never seeds, except when artificially fertilised, a fact

which is due to the absence of a particular insect which abounds in the native country of the Vanilla. A still more interesting example is afforded by the rust of the wheat, caused by a species of fungus, *Puccinia graminis*, which in order to survive must germinate on the leaves of the Barberry, where the fertilisation is performed. This fact was first observed by the late Danish Professor Oersted, and has been practically corroborated by the good results of almost eradicating the common Barberry in Denmark, where it was formerly very frequent. Similar mutual relations between plants are common among several other species of fungus. The most important assistants to fertilisation are wind, dew and insects, and rarely water.

Having now mentioned the most important conditions for the distribution of plants, I shall proceed to deal with the means by which it is performed.

The most natural way of propagation of plants is by seeds, and the different agents that assist in spreading or distributing these are *wind, water, animals, birds, insects, and plants themselves*.

The most active of these agents is the *wind*, and very frequently fruits and seeds are specially fitted to derive the full advantage of its action. As examples I shall mention the *feathery tailed fruits* of "Traveller's joy," of which at least one species, *Clematis Gouriana*, is common in our jungles; in this case the elongated styles serve as appliances for flight; or the *pappus* of most of the common *Compositæ*; beautiful, feathery, in the now common, but originally introduced *Tridax procumbens*, or hairy in *Blumeas*, *Vernonia cinerea*, *Emilia sonchifolia* and many other common weeds. Here the calyx or the outer perianth of the florets is adapted for flight. Hairy appendages of other kinds, *comas*, are frequent on seeds of several *Asclepiada*, as *Calotropis gigantea*, *Asclepias curassavica*, *Cryptostegia grandiflora*, and in many *Apocynæ* as *Anodendron paniculatum*, Dr. Macdonald's seed-traveller, &c., and in a great many other plants. The hairy appendages of seeds in the cotton-plants, *Gossypium*, in silk cotton trees, *Eriodendron anfractuosum* and *Bombax malabaricum* serve a double purpose, *e.g.*, as appliances for flight and as a means of adhesion to the skin of animals. Other appliances for flight are the winged fruits and seeds, as of *Combretum*, *Terminalia glabra*, the "Ain," which on account of its 5-winged fruit has been called *Pentaptera*, *Hiptage Madablota*, many other *Malpighiaceæ*,

*Cardiospermum Halicababum*, *Begonias*, many *Umbelliferous* plants, grasses, &c., where the entire fruit is winged ; of all *Bignoniaceæ*, as *Oroxylum indicum* and *Heterophragma Roxburghi*, the horse radish tree, *Moringa pterygosperma* and many *Sterculiaceæ*, as *Pterospermum acerifolium*, *P. suberifolium*, *Melochia velutina*, &c., and in several other plants, where the seeds are winged. Occasionally the fruit is enclosed by a withering calyx or bracts, that serve as appliances for flight, as in *Physalis* and *Bougainvillea*. Very small seed which are frequent occurrence and the spores of *cryptogamous* plants are also largely distributed by the wind. Finally, the actual force of the wind materially assists other plants in dropping their heavy fruits, which on account of their often round shape then continue their fall for some distance. In the case of the famous Rose of Jericho, *Anastatica hierochuntica*, and a few *Selaginellæ*, the entire shrivelled plant, with seed and all, is carried away by the wind.

The action of water in regard to distributing seeds is of less importance now than in former periods. But in the times of the great physical revolutions which our globe has undergone, before assuming its present shape, and long before the existence of man, the great majority of plants must have been distributed through the agency of water,—it is at least very difficult otherwise to explain the wide range of distribution for certain species, which have been preserved and identified in a fossil state. It is moreover probable that the sea of those periods has been free of salt, and consequently not so injurious to plant life as it at present is. This theory has, however, been severely disputed. It is remarkable to notice that adaptation of fruits and seeds for distribution by water is now-a-days mostly found in such plants that are nearest allied to the gigantic herbs of former periods, as in the fruits and seeds of several palms, and in the spores of many cryptogamic plants. The structure of the cocoanut is a good example of such fruits. Under the hard shell is found a thick layer of fibre, which is evidently intended for keeping the nut afloat, while the kernel abounds in fatty substances, which further protect the germ against the injurious effects of water. In other palm fruits, as in the African oil palm, *Elaeis guineensis*, the fibre is replaced by a layer of fat or solid oil, which may be regarded both as an adaptation for floating and as a protection against water. The large distribution of especially the cocoanut palm in all tropical countries, as also the



splendid vegetation of many Coral islands may, to a certain extent, be attributed to distribution by the sea, though it is a fact that salt water will kill most germs of plant life, unless they are protected by the above or similar means. Other fruits and seeds—sometimes whole plants—are occasionally distributed by fresh water, rivers, streams, or floods, but, as a whole, this agency cannot be considered a very important one. More active is the rain, and in colder climates the snow and the ice. The principal action of rain in regard to distribution of plants is to bury the seed in the ground, and as a whole to assist in the germination of seeds. Seeds of some plants, as many *Geraniaceæ*, several grasses, &c., are *hygroscopic*—a quality which by alternative expansions and contractions causes a certain movement, probably intended for shifting the seeds from one place to another; and according to observations by F. Darwin, for burying the seeds in the ground.

Though animals, birds, and insects but too frequently damage our choicest plants and fruits, their assistance in the distribution of plants is very important, and seeds and fruits are frequently adapted to take advantage of this fact.

The hairy or woolly appendages of seeds and fruits, which I have mentioned as adaptations for flight, as also the pubescent and tomentose seeds that frequently occur in *Malvaceous* plants, &c., are often of such a nature that they adhere to the skin of animals, and are distributed by these. In other cases seeds and fruits are provided with *hooks*, *bristles*, *awns*, *glands*, *tubercles*, or similar appendages, which cause them to stick to the skins of animals. Such structures are common features in many grasses, *Umbelliferae*, *Compositæ*, *Rubiaceæ*, &c., and are frequently met with in common weeds, as in *Achyranthes aspera*, *Sida carpinifolia*, *Mimosa pudica*, *Paracaryum*, *Plumbago zeylanica*, &c. More direct is the agency of monkeys, flying foxes, and larger birds, which are frequently attracted by the colour and fragrance of the succulent fruits, eat them and throw the seeds away, often at a considerable distance from the place of production. Birds as a whole are still more active distributors of plants, at least of those numerous species that have a berried, baccate or drupaceous fruit. Such fruits have generally a gay colour, are frequently sweet and aromatic, and are altogether well suited to tempt the birds. Experience has also established the fact that many seeds fail to germinate, unless having passed through the birds. Such seeds may, however, succeed when submitted

to fermentation. This is the case with many Indian species of *Ficus*, and you will all have observed how frequently plants of "Peepul," *Ficus religiosa*, "Banyan," *Ficus indica*, and "Umbar" *Ficus glomerata*, spring up on walls, roofs, and on stems of other plants, &c., on places where the seeds could not have been deposited except by birds. The naturalisation in India of several plants, as the Guava, the Custard apple, *Lantana camara*, *Passiflora suberosa*, *Rauwolfia canescens*, *Rivinia*, and many others may be explained by the action of birds. It is, however, worth noticing that the seeds of such fruits are generally well protected, either by a hard shell or by acrid qualities, as in the custard apple and the guava. Several species of plants are said to be distributed by the aid of insects, and as examples of such have been mentioned oranges, limes, papayas, and coffee.

The plants themselves have occasionally fruits, that in force of their peculiar structure, greatly assist in spreading the seeds. Such fruits are the *elastically bursting* seed-vessels of *Oxalis corniculata*, *Balsams*, *Momordica Balsamina*, *Rungia parviflora*, *Calotropis gigantea*, &c. The *sudden bursting* of the fruit, even when not elastic, will frequently occasion a shock, sufficiently strong to spread the seeds. In other cases the seeds remain in the fruit after its bursting, but have then generally some other adaptation for distribution, as the *winged* seeds of *Pterospermums*, the *shining bright red seeds* of *Adenanthera pavonina*, which, probably owing to their colour, are carried away by birds or insects, or the birds are attracted by the *gay colour of the pericarp*, as in *Sterculias*, *Tabernæ montana crispa*, *Gymnosporia Rothiana*, *Momordica*, *Uharantia*, &c. The *sweet arillus* of many seeds, as found in *Pithecolobium dulce*, is probably a similar adaptation.

A very peculiar feature, evidently intended to affect a dense growth of plants of the same species, within suitable localities, &c., at the same time protecting the seed against salt water, is represented by some of our sea shore plants, which form the well known Mangrove swamps, as *Rhizophora* and *Ægiceras*. In these the ripe seed germinates *on the mother plant*, and with its long radicle and narrowly adpressed leaves forms a stick-like plant. This, when finally separating, buries itself in the mud, where it, on account of its shape, is singularly adapted to withstand the movements of the tide. A somewhat similar example is afforded by *Crinum asiaticum*, where the seeds frequently germinate in the capsule and form small bulbs.

Only lately I noticed that the spores of an aquatic fern brought from Rutnagherry, a species of *Ceratopteris*, germinate and form their prothallium on the lower portion of the plant.

Many plants principally owe their distribution to other parts than to seeds, which then occasionally fail to come to perfection. Such plants are as a rule much more difficult to destroy than seedlings. The parts which serve to distribute the plants are, in such cases, *bulbs, tubers, rhizomes*, but principally *stoloniferous roots* as in many common grasses, as *Cynodon dactylon*, *Sporobolus diander*, *Chloris barbata*, *Dactylis lagopoides*, &c., or rooting stems or *runners* as in *Hydrocotyle asiatica*, *H. rotundifolia*, *Oxalis corniculata*, *Ipomœa biloba* and *I. aquatica*, *Lippia nodiflora*, &c. Rarely the *flower stem* is creeping and gives rise to new plants, as in the not uncommon *Launœa pinnatifida*. Among Indian plants a few reproduce themselves by parts of the *leaves*, as *Bryophyllum calycinum*.

All the artificial means of propagation are founded on the fact that every part of a stem or leaf has the power of forming a new plant, when brought under favourable conditions, and I think they are too well known to require mention here.

But, in considering the means of artificial propagation, it is only natural to think of cultivation as a cause, and a very important one too, of distribution of plants. By this not only a vast number of economical and ornamental plants have been distributed over the whole globe, but many plants have also unintentionally been naturalised in foreign countries as followers of cultivated plants. In regard to cultivation I may venture to say that in no other branch of natural science have so successful and astonishing results been obtained through the influence of man. The prosperity of most countries does in fact to a great extent depend upon cultivation, and I do not think I exaggerate when saying that by far the greatest part of the enormous Indian trade is due to cultivation, all the principal articles of export being vegetable products.

Such astounding results have however not been obtained without labour, the object of which has been to create better varieties, partly by selection and partly at the cost of extinction of the natural means of protection and adaptation for distribution found in the original plants.

Great successes in cultivation have been achieved in India, but I do not think that it is sufficiently appreciated that such results are frequently in the first instance due to experiments in botanical

gardens, among which the Calcutta garden has taken the lead by distributing such important plants as tea, cinchona, potatoes, and most English vegetables. There still remains a vast field for further progress, either by introducing exotic economical plants, or what I think is still more important, by careful examination of the qualities of the vast number of Indian plants, and how these may be improved and turned to account by cultivation.

The Hon'ble Mr. Justice Hart proposed a vote of thanks to Mr. Carstensen for his interesting lecture, and the meeting then ended.

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### HINTS ON COLLECTING AND PRESERVING HYMENOPTERA.

BY CAPTAIN C. T. BINGHAM,

Deputy Conservator of Forests, Rangoon.

**HYMENOPTERA.**—Ants, bees, and wasps *can* be collected and preserved in spirits: but somehow such specimens when set out and placed in the cabinet never look well. Ordinary methylated spirits, rectified spirits of wine, whisky, brandy, gin or whatever alcoholic medium individual collectors fancy; all alter or cause the colour of delicately marked specimens to fade, render them brittle, and invariably clog the tufts of fine hair and the down which adorn so large a number of the species belonging to this order. Ants alone do not suffer so much, especially if good methylated spirit, diluted with about one-third of its quantity of distilled water, is used.

Bees and wasps should be killed in an ordinary insect collecting bottle, containing cyanide of potassium made into a paste with plaster of Paris. A killing bottle just as effective can be made with far less trouble in the following way:—Take an ordinary four or eight ounce wide-mouthed bottle, or for very large insects, a prune jar does very well, fit with a tight cork long enough to project well above the rim of the bottle and give a good hold to the fingers. Put a lump or two of cyanide of potassium at the bottom, and cover over this to the depth of an inch or an inch and a half with coarse dealwood saw-dust (the coarser the better). Lastly, wedge a piece of thin cardboard, pierced with large pin holes and cut down exactly to the size of the inside of the bottle, on the top of the saw-dust. In very hot dry weather it will be as well before putting in the cardboard on the top to damp the saw-dust slightly. The advantages

of this bottle are that it can be prepared or renewed in a few minutes, and that its effectiveness lasts for so long a period. I have bottles at present in use that I prepared more than two years ago. When the overlying cardboard gets saturated with the cyanide and rotten, a fresh piece should be put over it, which ought also to be pierced with pin holes. Occasionally, from the jolting a collecting bottle gets in the collector's pocket or wallet, the saw-dust and cyanide get loose, and the latter is apt then to injure with its weight and the shaking any delicate specimens there may happen to be in the bottle ; but with a little care in occasionally pressing down the cardboard with the top of a pencil say, such mishaps can well be avoided. The reason I have recommended dealwood saw-dust is that having once prepared a bottle with teak saw-dust, I was surprised to find specimens of wasps I had caught and left in the bottle for a day or two change colour in a most wonderful manner ; yellow was the only colour affected, and this changed to a bright crimson,\* a pleasing æsthetic contrast with black no doubt ; but the deuce and all if the specimen altered in colour happens to be your sole example of a rare species. What it was in the teakwood and cyanide of potassium blending that affected the yellow colour in the insects I am not chemist enough to determine. Dealwood saw-dust seems to be unaffected by the cyanide.

For capturing Hymenoptera an ordinary butterfly-net will do, only the meshes of the mosquito gauze of which it is made should be somewhat fine, otherwise diminutive Chrysidæ, Scoliadæ, and Mutillidæ will manage to creep out.

As soon after capture as possible, the insects if large should be pinned into a pith or cork lined store-box, or if very tiny fixed with a little pin's-head drop of clear gum on the apex of a small isosceles triangle cut out of thin cardboard (ordinary visiting come in handy here), and with a pin passed through the cardboard put into the store-box. When the pin is put into the insect itself, it should be passed through the thorax, and out at the breast between and a little behind the front pair of legs. In all cases use long pins, so as to keep the insects well clear of the floor of the box or cabinet-drawer. It is not absolutely necessary but with all, except the smallest insects, to facilitate examination, it is better to set out the wings horizontally at right angles to the body as in flight, and the legs as much

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\* I can give any brother collector specimens of *Pelopæus spirifex* and *Polistes hebraeus* colours brilliant crimson and black—unique, I assure them.

in the natural position of the insect walking as possible. For this setting boards similar to those used for butterflies will be required.

If Hymenoptera are collected simply with a view to transmission by the post, after killing in the cyanide bottle they can be put into little triangular envelopes of paper, as butterflies very often are, each insect, however small, requiring a separate envelope. They will not, however, keep long thus, the fat-bodied heavy bees especially getting mouldy, greasy, full of mites, and often rotting. For quick transmission, however, this method of collecting answers very well, a number packing into a small box.

Hymenoptera as a rule affect bright sunny spots and flowering trees and shrubs. My experience is that insects belonging to the families Sphegidae, Pompilidae, and Larridae keep as a rule to low bushes, and are often to be found walking on the ground in an excited eager way searching for spiders, grass-hoppers, &c., with which they store their mud nests. Scoliadæ are sluggish creatures and can be picked off flowers with a pair of forceps. Mutillidæ, Ichneumonidæ, and Tenthredinidæ are brutes to find and catch, and when caught, to preserve with legs, antennæ, and ovi-positors intact.

Formicidæ (ants) are everywhere. They can, as I have already said, be collected in spirits ; but specimens should always be set up fixed by a drop of gum on cardboard triangles as described. It is difficult often to get hold of males and queens, and the collector has nearly always to fight for them. In default, however, one is thankful to get hold of the workers or neuters.

I shall be thankful if any of the readers of this magazine will collect hymenoptera and send them to me packed in paper envelopes in a small tin-box by post. In return I will engage to send back all specimens sent, naming such as I am able to identify, or to exchange for them Burmese hymenoptera, or named specimens in paper of Burmese butterflies.

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### SOME COLD WEATHER NOTES FROM GUZERAT.

BY CAPTAIN E. F. BECHER, R.A., F.Z.S.

THIS last cold weather in Guzerat has been chiefly remarkable for the scarcity of snipe, the cause of which was want of late rains, large jheels, in which snipe last year were shot in December, being dry by the end of October. Duck have also been scarcer, I am told, than last

year even in places where there was plenty of water. The snipe have evidently gone on to other places, I hear from Kirkee, for instance, that it has been a very good snipe year there. Quail have also been scarce, and I have never seen them in any numbers. The most numerous duck have been the Gadwall (*Chaulelasmus streporus*), the White Eye (*Nyroca ferruginea*), the Tufted Duck (*F. cristata*), the Spotted Bill (*Anas pæcilorhyncha*), and of course the Shoveller (*Spatula clypeata*). Of these the Gadwall was in most numbers; the Shoveller was not so numerous, as I was given to understand would be the case.

Sportsmen are very apt to call the Tufted Duck, the Golden Eye, from the fact of its having golden irides. This may give rise to error, as the Golden Eye is the accepted name of *Clangula glaucion*, which, according to Barnes, has only twice been recorded in India. The Spotted Bill was very common, but it is liable to be thought more numerous than in reality, as it is a large, slow-flying bird, and at once attracts attention.

An odd Pochard (*F. ferina*) was occasionally seen in the bag, as also the Red-crested (*F. rufina*). The Mallard (*Anas boschas*) was seen a little oftener both in the bag and out. The Brahminy Duck (*Tadorna casarca*) was, I think, in about equal numbers to the Mallard. During October on one occasion I saw on two tanks large numbers of the Pintail (*Dafila acuta*). Since then I have only seen an odd one or two occasionally, and never a flock.

A Widgeon I never saw shot or noticed alive. As regards the Teal—the Common Teal (*Querquedula crecca*)—was common. Of the Garganey (*Q. circia*) I only saw a few and none in full plumage. The Marbled Teal (*Ch. angustirostris*) was fairly common, which I believe is unusual. This species can easily be passed over, when flying, as a duck, on account of its large expanse of wings. The Cotton Teal (*Nettion coromandelianus*) at the commencement of the season was to be seen on nearly every tank, but latterly it became decidedly rare. Several Whistling Teal (*Dendrocygna javanica*) were noticed from time to time.

The only Goose I saw shot was the Grey Goose (*Anser cinereus*). Geese flying over were frequently seen, which were no doubt of this species.

On one occasion near Dungarwa, on approaching a very “ducky” looking tank, my shikari told me that there would be no duck there, as there were several muggers in it, and, true enough, there was not

a single duck or coot to be seen on the surface. This seems strange, as on other tanks, where muggers also live, I have seen plenty.

One early morning a long single rank of Pelican flew over doubtless *Pelicanus javanicus*; there were a great number of them. This is the only occasion on which I saw a pelican of any species, except once, when I saw a solitary individual of the above.

Tern were numerous. The only specimen I shot was the Whiskered Tern (*Hydrochelidon hybrida*). I do not remember seeing many Gulls proper.

I did not notice any Spoonbills until December; I do not know whether it is well known what a good bird it is for the table; its method of feeding is peculiar, advancing rapidly and moving its bill from side to side, in fact zig-zag.

A female Florican was shot in November, and I saw another during December.

I see that Barnes in his "Birds of Bombay" gives as the common name for the Common Crane *Kullum*, and for the Demoiselle Crane *Karonch*, which I presume is the same as *Koong*; in Sind the contrary was the case.

Our last day's duck-shooting was on the 18th February, when the majority seemed to have acquired that strong flavour called "fishy," on which account we did not go after them any more, as it would have been useless slaughter.

I did not examine every Snipe we shot, but I did a good number, and did not come across a single Pintail.

Flamingo were very common near Dungarwa; on one large tank I think their numbers might be reckoned by thousands, and from a little distance, when they were all on the wing together, their white plumage made it a most beautiful sight: all I saw were *Phaenicopterus antiquorum*.

From birds to beasts. I believe that Ahmedabad District has been famous for the number of antelope. Last year two French gentlemen destroyed a great number, over a hundred they say, with the result that in places where last year were hundreds, there now are hardly any, and none with any heads worth obtaining. In January I was in the neighbourhood of Parantij and Sonasan, a well-known locality for buck. I saw one with six inch horns and a doe. The number of snipe, &c., also shot by the above two sportsmen (?) was enormous and useless. They arrived in the country with the highest introductions, and the District Officers were requested to do all



they could to put them in the way of getting sport, with the above result. They have reappeared again this year on the scene of their former massacre.

Since writing the above, I have heard that the Nal Cup cannot be run in the usual country, as the pig have left the neighbourhood on account of want of water.

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## ON THE LEPIDOPTERA OF KARACHI AND ITS NEIGHBOURHOOD.

By COL. C. SWINHOE, F.L.S., F.Z.S., &c.

### PART II. HETEROCERA.

#### SPHINGIDÆ.

#### 1

*Macroglossa stellatarum.*

*Sphinx stellatarum*, Linn., Syst. Nat. 1, 2, p. 803 (1767).

One specimen, July, 1879; it is a common insect at Quetta and in the Bolan.

#### 2

*Macroglossa gyrans.*

*Macroglossa gyrans*, Walker, viii., p. 91 (1856).

July, 1885. Very plentiful for about a fortnight.

#### 3

*Macroglossa belis.*

*Sphinx belis*, Cram., Pap. Exot., i., p. 147, pl. 94, f. C. (1776).

*Macroglossa assimilis*, Swainson, Zool. Ill., Ser. i., vol. i.  
pl. 64 (1820).

„ *zena*, Boisd., Spec. Gén. Lep. Hist., 1875, i.,  
p. 337.

„ *pyrrhulla*, Boisd., l. c., p. 338.

Common in July, 1885.

#### 4

*Charocampa elpenor.*

*Sphinx elpenor*, Linn., Faun. Svec., p. 288 (1746).

One example identical with the British type received from the Municipal Museum taken in Karachi.

## 5

*Chærocampa theylia.*

*Sphinx theylia*, Linn., Syst. Nat. 12, 803, 24 (1767).

„ *bæchaviæ*, Fabr. Sp. Ins. ii., 148, 39.

„ *pluto*, Fabr. Sp. Ins. ii., 148, 40.

„ *pinastrina*, Martyn, Psyche, pl. 30, f. 85 (1797).

„ *octopunctata*, Gmel., Syst. Nat. i., 5, 2386.

One taken in July, 1886, and three in the following September.

## 6

*Chærocampa celerio.*

*Sphinx celerio*, Linn., Syst. Nat. x., 491 (1758).

„ *tisiphone*, Linn., l. c. 492.

*Hippotion ocys*, Hübn., Verz. bek. Schmett, 135, 1451 (1816).

*Deilephila inguinalis*, Harris, Ex., p. 93, pl. 28, f. 1.

November and December.

## 7

*Chærocampa oldenlandiæ.*

*Sphinx oldenlandiæ*, Fabr., Sp. Ins. ii., 148 (1781).

*Xylophanes gortys*, Hübn., Samuel. Exot. Schmett. Zutr.,  
f. 513, 514 (1825).

December.

## 8

*Chærocampa alecto.*

*Sphinx alecto*, Linn., Syst. Nat. x., p. 492 (1758).

„ *cretica*, Boisd., Ann. Soc. Linn., Paris, vi., p. 118,  
pl. 6, f. 5 (1827).

Very plentiful in July, 1886. One taken in August and three in September.

## 9

*Chærocampa nesus.*

*Sphinx nesus*, Drury, Ill. Ins. Exot. ii., p. 46, pl. 27, f. i.  
(1773).

„ *equestris*, Fabr. Ent. Syst. ii., p. 365 (1773).

*Chærocampa rubicundus*, Schanfuss., Nunquam Otiosus i.,  
p. 18 (1870).

One taken in October, 1879.

## 10

*Deilephila livornica.*

*Sphinx livornica*, Esper., Ausl. Schmett. ii., pp. 87, 196, pl.  
8, f. 4 (1785).

„ *lineata*, Fabr., Sp. Ins. ii., 147, 34.

March and May, 1879-80. July, August, and September, 1886, in great plenty.

11

*Daphius nerii*.

*Sphinx nerii*, Linn., Syst. Nat. i., 2, p. 798 (1767).

March, April, and May, very common.

12

*Polypitchus dentatus*.

*Sphinx dentata*, Cram., Pap. Exot. ii., p. 42, pl. 125, f. G., (1779).

Two taken in October, 1885.

13

*Acherontia styx*.

*Acherontia styx*, Westw., Cab. Or. Ent., p. 88, pl. 42, f. 3 (1848).

July and August, very common.

14

*Protoparce orientalis*.

*Protoparce orientalis*, Butler, Trans. Zool. Soc. ix., p. 609, pl. 91, f. 16 and 17, larva and pupa (1876).

March to September. Very plentiful during July, August, and September.

15

*Nephele hespera*.

*Sphinx hespera*, Fabr., Syst. Ent., p. 546 (1775).

„ *chiron*, Cram., Pap. Exot. ii., p. 62, pl. 137, f. E (1779).

„ *didyma*, Fabr., Sp. Ins. ii., p. 148 (1781).

„ *morpheus*, Hübn., Verz. bek. Schmett., p. 133 (1816).

*Peregonia obliterans*, Walker, xxxi., 28 (1864).

One taken in August, 1886.

16

*Hemaris hylas*.

*Sphinx hylas*, Linn., Mant. i., p. 539 (1771).

„ *picus*, Cram., Pap. Exot. ii., p. 83, pl. 141, f. B (1777).

December, 1885.

## BOMBYCES.

## "ZYGÆNIDÆ."

## 17

*Syntomis cyssea*.

*Sphinx cyssea*, Cramer, Pap. Exot. iv., p. 124, pl. 355, f. B (1782).

*Zygæna collaris*, Fabr., Ent. Syst. iii., i., 388, 7 (1793).

*Syntomis schænerri*, Boisd., Mon. Zyg., p. 112, pl. 7, f. 1 (1829).

„ *cuprea*, Prittivitz, Stett. Ent. Zeit., p. 277 (1867).  
June, 1885; February, March, and April, 1886, in great numbers.

## 18

*Psichotoë duvancelii*.

*Psichotoë duvancelii*, Boisd., Mon. Zyg., p. 129, pl. 8, f. 5 (1829).

Three examples received from Jurruck, near Karachi.

## 19

*Euchromia polymena*.

*Sphinx polymena*, Linn., Syst. Nat. ii., 806, 40 (1766).

Several examples received from Mr Murray, taken in July, 1882.

## AGARISTIDÆ.

## 20

*Ægocera venulia*.

*Phalena venulia*, Cram., Pap. Exot. ii., 107, pl. 165, f. D (1779).

One taken in July, 1882; two in August, 1886.

## NYCTEOLIDÆ.

## 21

*Earias insulana*.

*Tortrix insulana*, Boisd., Faune Ent. Madag., p. 121, pl. 16, f. 9 (1833).

*Earias frondosana*, Walker, xxvii., 204 (1863).

„ *simillima*, Walker, xxxv., 1775 (1865).

Common in February; also from September to November.

22

*Earias speiplena*.

*Aphusia speiplena*, Walker, xii., 770.

*Micra partita*, Walker. xxxiii., 799.

August and September in great numbers.

23

*Earias tristrigosa*.

*Earias tristrigosa*, Butler, P. Z. S., 1881, p. 614.

Common throughout the year.

LITHOSIDÆ.

HYP SINÆ.

24

*Lacides ficus*.

*Noctua ficus*, Fabr., Ent. Syst. iii., 27, 62.

August, 1886.

LITHOSINÆ.

25

*Deiopeia pulchella*.

*Tinea pulchella*, Linn., Syst. Nat. i., 2, 884.

Common throughout the year.

26

*Deiopeia lotrix*.

*Phalæna noctua lotrix*, Cram., Pap. Exot. ii., p. 20, pl. 109,  
f. E (1777).

Hubb River, November, 1879.

27

*Deiopeia thyter*.

*Deiopeia thyter*, Butler, Trans. Ent. Soc. 1877, p. 361.

Hubb River, November, 1879.

ARCTIDÆ.

28

*Cretonotos interrupta*.

*Phalæna interrupta*, Linn., Syst. Nat. Phul. i., v., p. 2558,  
116.

*Bombyx francisca*, Fabr., Mant. Ins. ii., pp. 131—200 (1787).  
March, 1886.

## 29

*Aloa lactinea.*

*Phalæna lactinea*, Cram., Pap. Exot. ii., 58, pl. 133, f. D.

*Bombyx sanguinolenta*, Fabr., Desc. Ins. Ind., pl. 33.

A variety without the red collar was in great plenty in August, 1885, and July, 1886.

## LIPARIDÆ.

## 30

*Charnidas testacea.*

*Cynia testacea*, Walker, iii., p. 633.

May, 1886.

## 31

*Loelia pallida.*

*Loelia pallida*, Moore, Trans. Ent. Soc. 1884, p. 35.

Plentiful in August, 1885, and a few in September and October ; taken also in the same months in 1886.

## 32

*Artaxa pusilla.*

*Artaxa pusilla*, Moore, Lep. Ceylon ii., p. 86, pl. 112, f. 14 (1882).

*Euproctis pygmæa*, Moore, Desc. Lep. Coll. Atk. i., p. 48, (1879) (*nom preoc.*).

Males common from April to October : the female (probably an apterous insect) is unknown.

## 33

*Somena subnotata.*

*Orvasca subnotata*, Walker, xxxii., p. 502, ♂ (1865).

August and November, 1879 ; February, 1880.

## 34

*Thiacidas postica.*

*Thiacidas postica*, Walker, v., p. 1028.

August and September.

## NOTODONTIDÆ.

## NOTODONTINÆ.

## 35

*Anticyra combusta.*

*Anticyra combusta*, Walker, v., p. 1092.

*Dinara lineolata*, Walker, vii., p. 1699 (1856).

One taken at Karachi, date not noted.

36

*Ingura subapicalis*.

*Abrostola subapicalis*, Walker, xxii., p. 883.

*Ingura recurrens*, Walker, xv., p. 1779.

Plentiful in July, 1886.

CALPINÆ.

37

*Oræsia vagabunda*.

*Oræsia vagabunda*, Swinhoe, P.Z.S., 1884, p. 519, pl. 47,  
f. 5.

May, 1880.

LASIOCAMPIDÆ.

38

*Taragama ganesa*.

*Bombyx ganesa*, Lefebvre, Zool. Journ. iii., p. 211 (1827).

„ *siva*, Lefebvre, loc. cit., p. 210.

*Megasoma albicans*, Walker, vi., 1450.

May and September.

39

*Chilena similis*.

*Chilena similis*, Walker, v., p. 1071.

Hyderabad, April, 1886.

COSSIDÆ.

40

*Zeuzera bivittata*.

*Zeuzera bivittata*, Walker, xxxii., p. 586.

Two taken in July, 1886, and one in the following month.

41

*Zeuzera acronyctoides*.

*Brachylia acronyctoides*, Moore, P. Z. S., 1879, p. 411, pl. 34,  
f. 4.

April and May.

42

*Phragmataecia fæda*.

*Phragmataecia fæda*, Swinhoe, P.Z.S., 1884, p. 515, pl. 47,  
f. 1.

January, February, and March.

## NOCTUES.

## LEUCANIDÆ.

## 43

*Leucania loreyi*.

*Leucania loreyi*, Duponchel, Hist. Nat. Lep., France iv., p. 81,  
pl. 105, f. 7.

February to May.

## 44

*Sesamia inferens*.

*Leucania inferens*, Walker, ix., p. 105.

Hyderabad, April, 1886.

## HELIOTHIDÆ.

## 45

*Heliothis peltigera*.

*Noctua peltigera*, Denis, Wien. Verz., p. 89.

„ *barbara*, Fabr., Ent. Syst. iii., 2, iii., 354.

„ *florentina*, Esper., Schmett., iv., pl. 135, f. 2.

„ *scutigera* Bork., Eur. Schmett., iv., 93, 37.

„ *straminea*, Donovan., Brit. Ins. ii., pl. 61.

*Phalæna alpheia*, Cramer, Pap. Exot. iii., 99, pl. 259, f. F.

June to October common.

## 46

*Heliothis armigera*.

*Noctua armigera*, Hübn., Noct. ii., p. 180, pl. 79, f. 370  
(1804).

January, 1880, in great numbers; July and August, 1885;  
September, 1886.

## 47

*Heliothis rubescens*.

*Thalpophila rubescens*, Walker, xv., p. 1681 (1858).

May, 1885, in great numbers, and again in October, 1886.

## 48

*Adisura leucanioides*.

*Adisura leucanioides*, Moore, P.Z.S., 1881, p. 368.

Muggur Pir, August, 1880.

## ACONTIDÆ.

## 49

*Xanthodes stramen*.

*Xanthodes stramen*, Guenée, Noct. ii., 210, 976.

September, 1885; July, August, and September, 1886.



50

*Xanthodes imparata*.

*Xanthia imparata*, Walker, x., 467.

July, 1886.

51

*Xanthodes innocens*.

*Xanthodes innocens*, Walker, p. 1752.

September, October, and November.

52

*Xanthodes arcuata*.

*Xanthodes arcuata*, Walker, xii., p. 779.

February, 1880.

53

*Euphasia catenula*.

*Noctua catenula*, Sowerby, Brit. Mus. 29, pl. 14.

*Desmophora elegans*, Steph., Cat. Brit. Mus. 6398.

Miani, February, 1886; Karachi, June, 1886.

54

*Euphasia catenula*.

*Euphasia catenula*, Walker, xxxiii., p. 780.

September, 1885.

55

*Acontia costalis*.

*Acontia costalis*, Walker, xxxiii., 784.

August, 1885.

56

*Acontia basifera*.

*Acontia basifera*, Walker, xii., 793.

Hubb River, September, 1885; Karachi, July, August, and September, 1886.

57

*Acontia crocata*.

*Acontia crocata*, Guenée, Noct. ii., 218, 939.

August, 1886.

58

*Acontia scanda*.

*Acontia scanda*, Felder, Reise Novara, pl. 108, f. 27, ♀.

September, 1886.

59

*Acontia hortensis*.

*Acontia hortensis*, Swinhoe, P. Z. S., 1884, p. 517, pl. 47, f. 7.

September, 1880 and 1885.

## 60

*Bankia opella.*

*Acontia opella*, Swinhoe, P. Z. S., 1885, p. 456, pl. 27, f. 16.  
September, 1885; in great numbers in July and August, 1886.

## 61

*Tarache inda.*

*Acontia inda*, Felder, Reise Novara, pl. 108, f. 23, ♀.  
September, 1886.

## 62

*Marimatha lactea.*

*Marimatha lactea*, Swinhoe, P. Z. S., 1884, p. 522, pl. 48, f. 7.  
May, 1880; September, 1885.

## ERASTRIDÆ.

## 63

*Erastria futilis.*

*Erastria futilis*, Swinhoe, P. Z. S., 1884, p. 517, pl. 47, f. 8.  
March, 1880.

## ANTHOPHILIDÆ.

## 64

*Thalpochares rivula.*

*Thalpochares rivula*, Moore, Desc. Lep. Coll. Atk. ii., p. 140  
(1882).  
July, 1885; April, 1886.

## 65

*Anthophila derogata.*

*Micra derogata*, Walker, xii., p. 825 (1857).  
Hubb River, August, 1880.

## 66

*Anthophila zamia.*

*Anthophila zamia*, Swinhoe, P.Z.S., 1884, p. 518, pl. 47, f. 12.  
April, 1880.

## 67

*Anthophila bulla.*

*Anthophila bulla*, Swinhoe, P.Z.S., 1884, p. 518, pl. 47, f. 9.  
From October to January common.

## 68

*Micra chalybea.*

*Micra chalybea*, Swinhoe, P. Z. S., 1884, p. 518, pl. 47, f. 10.  
September and October common.

69

*Micra furia*.

*Micra furia*, Swinhoe, P. Z. S., 1884, p. 519, pl. 47, f. 13.  
September, 1880.

70

*Micra balux*.

*Micra balux*, Swinhoe, P. Z. S., 1884, p. 519, pl. 47, f. 14.  
August to October common.

71

*Leptosia quinaria*.

*Leptosia quinaria*, Moore, P. Z. S., 1881, p. 371.  
September to November.

ORTHOSIDÆ.

72

*Orthosia infrequens*.

*Orthosia infrequens*, Swinhoe, P. Z. S., 1884, p. 517, pl. 47,  
f. 11.  
July, 1880.

NOCTINIDÆ.

73

*Agrotis aristifera*.

*Agrotis aristifera*, Guen., Noct. i., p. 266 (1852).  
" " Walker, x., p. 348 (1856).  
February, 1880; April, 1886.

74

*Agrotis segetum*.

*Agrotis segetum*, Schiff., Wien. Verz., p. 252 (1776).  
Hyderabad, April, 1886.

75

*Spælotis undulans*.

*Spælotis undulans*, Moore, Ann. Mag. Nat. Hist. (5) i., 1878,  
p. 233.  
November, 1880.

AFAMIDÆ.

76

*Ilattia cephusalis*.

*Ilattia cephusalis*, Walker, xvi., 209.  
*Miana inornata*, Walker, xxxii., 677.  
*Perigea leucospila*, Walker, xxxii., 683, ♂.  
August, September, and October common.

## 77

*Caradrina sabulosa*.

*Caradrina sabulosa*, Swinhoe, P. Z. S., 1884, p. 516, pl. 47, f. 6.  
April, May, and June.

## 78

*Caradrina venosa*.

*Caradrina venosa*, Butler, Ent. Mo. Mag., xvii., p. 111 (1880).  
November, 1880.

## 79

*Caradrina insignata*.

*Caradrina insignata*, Walker, x., 295.  
May, June, and July.

## 80

*Spodoptera cilium*.

*Spodoptera cilium*, Guenée, Noct. i., 156, 249.

„ *insulsa*, Walker, xxxii., 648.

All the year round. Very plentiful in August.

## 81

*Prodenia nubes*.

*Spodoptera nubes*, Guen., Noct. i., 155, ♂ (1852).

„ *filium*, Guen., Noct. i., 155, ♀.

*Prodenia infecta*, Walker, ix., 196 (1856).

„ *insignata*, Walker, ix., 197.

*Agrotis transducta*, Walker, x., 344, ♀.

*Laphygma squalida*, Walker, xxxii., 652, ♂.

*Prodenia venustula*, Walker, xxxii., 654, ♀.

*Agrotis submarginalis*, Walker, xxxii., 699, ♀.

*Prodenia permunda*, Walker, ix., 728, ♀.

Taken on board the steamer leaving Karachi, October, 1886.

A rather variable insect, common in most parts of India, easy of identification, but Walker appears to have given a new name to every shade of colour it assumes.

## 82

*Prodenia littoralis*.

*Hadena littoralis*, Boisd., Faune Ent. Madag. Lep., p. 91,  
pl. 13, f. 8, ♀ (1834).

*Neuria retina*, Freyer, Beitr. Schif. v., 161, pl. 478, f. 2, 3,  
♂ ♀ (1846).

*Prodenia celigera*, Guen., Noct. i., p. 164, ♂ ♀ (1852).

„ *testaceoides*, Guen., Noct. i., p. 165, pl. 6, f. 7, ♀.

„ *glaucistriga*, Walker, ix., 197, ♂ (1856).

*Prodena subterminalis*, Walker, ix., 197, ♀.

„ *declinata*, Walker, xi., 723, ♂.

April, 1886. Also a common insect, rather variable in colour, with a name given for every variation.

83

*Laphygma exigua*.

*Noctua exigua*, Hübner, Samml. Ex. Schm. Noct., f. 362.

July to October common.

84

*Ozarba itwarra*.

*Ozarba itwarra*, Swinhoe, P. Z. S., 1855, p. 452, pl. 27, f. 14.

Very common in August and September, 1886.

PLUSIDÆ.

85

*Plusia chrysitina*.

*Phalœna noctua chrysitina*, Martyn, Psyche, pl. 21 (1797).

*Noctua aurifera*, Hübner, Ent. Schmett., Noct., pl. 98, f. 463.

Kipra, near Karachi, April, 1886.

86

*Plusia verticillata*.

*Plusia verticillata*, Guenée, Noct. ii., 344.

November to March.

87

*Plusia extraheus*.

*Plusia extraheus*, Walker, xii., 929.

March and April; July and August.

EURHIPIDÆ.

88

*Eutelia discistriga*.

*Eutelia discistriga*, Walker, xxxii., 823.

July, August, and September.

GONOPTERIDÆ.

89

*Cosmophila xanthindyma*.

*Cosmophila xanthindyma*, ♂, Boisduval, Faun. Ent. Madag.

Lep., p. 94, pl. 13, f. 7 (1834).

„ *indica*, ♀ Guenée, Noct. iii., 396, 1256 (1852).

*Cirrædia variolosa*, Walker, xiii., 750.

July, August, and September.

## 90

*Gonitis involuta.*

*Gonitis involuta*, Walker, xiii., 1003 (1857).

„ *basalis*, Walker, xiii., 1004, ♀.

*Tiradiata colligata*, Walker, xxxiii., 870 (1865).

Common in June.

## POAPHILIDÆ.

## 91

*Poaphila reflexa.*

*Plecoptera reflexa*, Guen., Noct. ii., 431, 1303.

*Trigonodes grammoides*, Walker, xv., 1833.

*Poaphila simplex*, Walker, xv., 1840.

„ *hamifera*, Walker, xxxiii., 992.

June, July, and August.

## XYLINIDÆ.

## 92

*Jarasana lativitta.*

*Jarasana lativitta*, Moore, Desc. Lep. Coll. Atk. ii., p. 132.

July, 1879 ; April and May, 1886.

## CATEPHIDÆ.

## 93

*Anophiu olivascens.*

*Anophia olivascens*, Guen., Noct. iii., 48, 1379.

September, 1886.

## HYPOGRAMMIDÆ.

## 94

*Selepa docilis.*

*Selepa docilis*, Butler, P. Z. S., 1881, p. 619.

April and May ; September to December common.

## 95

*Plotheia aenea.*

*Othora aenea*, Swinhoe, P. Z. S., 1884, p. 520, pl. 48, f. 1.

July, 1880.

## POLYDESMIDÆ.

## 96

*Pandesma quenavadi.*

*Pandesma quenavadi*, Guen., Noct. ii., 338, 1310.

*Cerbia fugitiva*, Walker, xiv., 1365.

June, July, and August in great numbers.

97

*Pandesma similata*.

*Pandesma similata*, Moore, P. Z. S., 1883, p. 24.

Cocoons from Shikarpur emerged April, 1879.

98

*Pandesma devia*.

*Pandesma devia*, Swinhoe, P. Z. S., 1884, p. 520, pl. 48, f. 3

May, June, and July.

HOMOPTERIDÆ.

99

*Homoptera vetusta*.

*Polydesma vetusta*, Walker, xxxii., 875.

April to July.

100

*Alamis infligens*.

*Homoptera infligens*, Walker, xiii., 1068.

July, August, and September.

101

*Alamis umbrina*.

*Alamis umbrina*, Guen., Noct. iii., 4, 1321.

„ *albicinata*, Guen., Noct. iii., 4, 1322.

July and September, 1866.

OPHIDERIDÆ.

102

*Argadesa materna*.

*Phalæna noctua materna*, Linn., Syst. Nat. ii., 840, 117 (1767).

*Noctua hybrida*, Fabr., Syst. Ent. 593, 11 (1775).

May and July, 1885.

103

*Othreis fullonica*.

*Phalæna noctua fullonica*, Linn., Syst. Nat. ii., 812, 16 (1767).

*Noctua discoreæ*, Fabr., Sp. Ins. ii., 212, 15; Syst. Ent. 593 (1775).

*Phalæna noctua pomona*, Cramer, Pap. Exot. i., 2, 122, pl. 77, f. C. ♀ (1779).

July, 1886.

## OMMATOPHORIDÆ.

## 104

*Patula macrops.**Phalæna attacus macrops*, Linn., Syst. Nat. 225 (1768).*Noctua bubo*, Cram., Pap. Exot. ii., p. 114, pl. 171, f. A.  
B. ♂ (1779).

July, 1886.

## BENDIDÆ.

## 105

*Hamodes aurantica.**Hamodes aurantica*, Guen., Noct. iii., 203, 1603.

January, 1880.

## OPHIUSIDÆ.

## 106

*Thyas coronata.**Noctua coronata*, Fabr., Syst. Ent. 596, 24 (1775).,, *leonita*, Fabr., Syst. Ent. 596, 25.,, *ancilla*, Fabr., Ent. Syst. iii., 2, 17 (1794).*Corycia majica*, Hübner, Samml. Exot. Schmett, iii., p. 32  
f. 535, 536.

August, 1886.

## 107

*Ophiodes seperans.**Ophiodes seperans*, Walker, xiv., 1357.

July, 1886, in great numbers.

## 108

*Achæa melicerte.**Phalæna noctua melicerte*, Drury, Ins. i., p. 46, pl. 23, f. 1  
(1770).*Noctua tigrina*, Fabr., Sp. Ins. 218 (1781).

Very common in July, 1882, and again in July, 1886.

## 109

*Serrodæ inara.**Phalæna inara*, Cram., Pap. Exot. iii., p. 78, pl. 239, f. E.

July, 1886.

## 110

*Ophiusa albivitta.**Ophiusa albivitta*, Guen., Noct. iii., 271.

July.



111

*Ophiusa stuposa.*

*Noctua stuposa*, Fabr., Ent. Syst. iii., 2, 42, 112 (1793).

*Ophiusa festinata*, Walker, xiv., 1432 (1858).

July, 1886.

112

*Ophiusa olympia.*

*Ophiusa olympia*, Swinhoe, P. Z. S., 1885, p. 466.

Taken on board the steamer leaving Karachi, October, 1886.

113

*Ophiusa arctotænia.*

*Ophius arctotænia*, Guen., Noct. iii., 272.

July, 1886.

EUCLIDIDÆ.

116

*Acantholipes affinis.*

*Docela affinis*, Butler, Ann. and Mag. Nat. Hist., ser. 5, vol. V. (1880), p. 225.

October to May common.

117

*Acantholipes acervalis.*

*Acantholipes acervalis*, Swinhoe, P. Z. S., 1886, p. 451.

September, 1885, and January, 1886.

118

*Trigonodes hippasia.*

*Phalæna noctua hippasia*, Cramer, Pap. Exot., iii., p. 99, pl. 250, f. E (1782).

*Trigonodes compar*, Walker, xvi., 1451 (1857).

January to June common.

REMIGIDÆ.

119

*Remigia archesia.*

*Phalæna noctua archesia*, Cramer, Pap. Exot., iii., p. 145, pl. 273, f. F. G. ♀ (1782).

*Remigia bifasciata*, Walker, xxxiii., p. 1014, ♀ (1885).

July and August.

## 120

*Remigia frugalis.*

*Noctua frugalis*, Fabr., Ent. Syst. iii., 2, p. 138 (1794).

*Remigia translata*, Walker, xxxiii., 1015, ♀ (1865).

July to October, common.

## 121

*Remigia arefacta.*

*Remigia arefacta*, Swinhoe, P. Z. S., 1884, p. 52, pl. 48, f. 2.

May, 1880.

(To be continued.)

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 ZOOLOGICAL NOTES.
 

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## HOT WEATHER NOTES IN THE CENTRAL PROVINCES, 1887.

BY CAPTAIN E. F. BECHER, R. A., F. Z. S.

LAST hot weather (1887) I spent in the jungles in the Central Provinces, not very far from Nagpore. The following are extracts from notes I wrote down at the time :—

During April I noticed a great number of night jars flying about at dusk and dawn with their perfectly noiseless flight. I was unable to identify the species. They for the most part used to make a constant chirping noise like a cricket. I fancied at the time that it was to attract the various chirping insects in the grass, who would answer, and thus disclose their whereabouts. I could not tell the difference between the sound of the night jar's chirp and that of the insect. A great number of large Cicadæ always used to be seen in the evening and early morning which used to take that locust-like flight. I have a note on the 22nd April : "In the evening, in the jungle, there were in one place hundreds if not thousands of Cicadæ seated on the small trees, which flew off as we passed, to the great danger of our eyes."

On the 17th April I shot two couple of pin-tailed snipe and eat them ; they were not good. I did a good deal of sitting up in *machans* with, as usual, no success. Something always occurred to spoil my chance. On one occasion a tiger woke me up in the early morning by killing the buffalo which I had tied up. It is an abused method of shikar, but I fail to see the reason ; for any one who takes an interest in other than the "beasts of the chase" it is most delightful. I used to take my bedding, notebook, water bottle and a couple of *chapatties* for dinner ; send all natives back to camp, and spend the whole night there. After one of these nights I find have written : "There seem to be distinct periods of insect annoyance and otherwise, commencing from about 4 P.M. First innumerable flies, principally a black T-like fly, of sluggish and pertinacious habits : one's eyes are the principal points of attack. As the sun goes down they disappear, and the Cicadæ turns up with a deafening chorus, but this ceases as darkness sets in, and then the mosquitoes have their time ; but I always found that the 12 feet or so of *machan* above the ground is above the thick mosquito stratum ; in the same place, but at water level, I have been driven away by them, clothes affording no protection, as they drove their lancets right through. Soon after taking up my position, some jungle or spur

fowl come and peck about by my tree, and perhaps a peacock or two, quite unconscious of my presence. Various birds utter their (to me) strange and loud notes; the monkeys leap from tree to tree, and numerous green parrots and crows, (*C. culminatus*) fly past. My *machan* overlooks a small pool in a nullah, overhung with some reeds and bushes. Round the edges are a great number of bulbuls, and of a small bird, which I could not identify, but whose characteristic was black, with a conspicuous white wing patch, and about the size of a *Munia*. These were busily engaged in their evening drink, and had taken possession of the adjacent bushes, where also could be seen the Paradise Flycatcher in its full plumage, both of white and brown, with steamer tail and erectile crest; also one or two of the short-tailed brown birds. In the trees are a number of brown vultures. I could not identify them, as I always mix them up, and noted general colour brown, with white chest, patch of ruff and white under the wings, bare or white patch on the thighs; but to my surprise, when I came to look at Barnes' book, I found that this was not enough for identification. These I had disturbed from their attack on the half-eaten carcass. One or two *Halcyon smyrnensis* took occasional dives into the pool. I thought at first that these I saw were smaller than the usual run of *H. smyrnensis*. Now and then a vulture wings his heavy flight from one tree to another with a great flapping of wings. I also see on the reeds and bushes one or two blue flycatchers (*Hypothymis azurea*), a green bee-eater (*Virides*) taking occasional short flights after some choice morsel. A solitary Scavenger Kite—more familiar perhaps with human beings—which has all this time been sitting gorged and dragged on a branch, sets the example of beginning again, and flops down near the carcass; of course one or two black crows have all this time been pecking away or standing on the sand close to, but on the kite's approach they only take a surreptitious snatch now and then. I next notice a solitary Yellow Wagtail (? sp.) and a babbling announces the approach of the band of seven (*M. terricolor*), but they have picked up a waif on the road. They all crowd into a little hollow where a little water lies, and where there is scarcely room for one. Several magpies fly amongst the trees, one or two Drongos (*B. atra*) join the assemblage on the bush and about 5 P. M., the cicada chorns commences. A white-bellied Drongo (*O. caerulescens*) next arrives, and as the sun gets very low, three or four green pigeons rattle past. A small hawk dashes past, causing a general stampede. Later on when all the small birds have gone to roost, this or another small hawk comes to drink. A large red squirrel, as it goes from tree to tree, adds variety to the scene, and just before sunset a number of doves perch in the trees. One or two vultures pick about the carcass with an occasional squabble. A solitary white neophron flies up the nullah, but takes no notice of the carcass: a solitary Roller flies over about 6-15.

"Two vultures which have been exploring the chest cavity of the dead buffalo appear to have found some choice morsel, which they cannot keep secret, for all the other vultures, which had been looking on for about an hour and a half with a great flapping of wings, suddenly join in, and begin tearing the carcass in all places, inasmuch that I fear that there will be nothing left for the tiger if he come. With the last gleams of sunshine the vultures fly off but a crow keeps on till the last. Monkeys noisily approach, grunting and jumping from tree to tree, or running

on the ground, and the strident call of the peacock re-echoes through the jungle ; a loud shrill-voiced bird repeats its one note, answered by two others in different parts of the jungle ; then more join in.

"Two large owls (? sp.) come and have a drink and a bathe, making a hoarse low whistle. A night-jar flits past with its squeaky note, and later a large yellow thing noisily drops down from the bank and drinks, and I—but what is the use of raking up old sores !

"I should have mentioned that I saw another bird, which I noted as a black drongo-like bird, with erectile crest and a long almost filamentous tail feather with a widened web at the end. This, I suppose, would be *Dissemorus paradiseus*. What is particularly noticeable in the jungle to the dweller in cantonment is towards evening the number of loud-voiced birds, with peculiar notes ; but I could never manage to get near enough to identify."

I have a note on the 30th May : "I have not noticed any squeaking night-jars lately ; perhaps those which have this call are a particular species ; nor lately have I heard the doves 'put all straight,' though there are plenty about. I have always been defeated in trying to ascertain what dove is always repeating 'put all straight.' It may not strike other people, but the words seem as plain to me, as 'Did he do it' of *Lobivanellus indicus*. I hear 'put all straight' at all hours of the day and night."

One evening I saw a small hawk, about the size of a merlin, but which I could not identify, flying off with some bird almost as large as itself, which turned out to be the Golden-backed Woodpecker ( *B. aurantius* ).

I saw many sambar during May, but they had all shed their horns ; there were plenty of horned cheetul. The Barking or Rib-faced Deer also appear all to have shed their horns early as April.

Whilst sitting in a *machan*, I frequently experienced the rain, which is alluded to in the "Indian Forester" of October 1878 thus : "An American tree, which also yields a sweet nutritious food, has been much more successful than the larch. This is the *Pithecolobium saman*, a native of Peru, which from its supposed property of inducing local showers is, in that country, known as the 'Rain tree.' " An exact description and explanation of the phenomenon, which gave rise to this name, has only quite recently been given in the columns of the English periodical *Nature* by Dr. Dyer, who quotes from the eminent South American traveller, Mr. Spruce, as follows : "A little after 7 o'clock we came under a lowish spreading tree, from which with a perfectly clear sky overhead a smart rain was falling. A glance upwards showed a multitude of Cicadas sucking the juice of the tender young branches and leaves, and squirting forth slender streams of limpid fluid. We had barely time to note this when we were assailed by swarms of a large black ant, \* \* \* which ants were greedily licking up the fluid as it fell." I am glad that my experience fell short of the ants.

I close this with a small episode, of which the moral is that people should be careful in recording the occurrence of any unusual beast or bird, which is not in the hand. One morning I was taking up a new camp near a jungle tank, and on approaching my camping ground, I passed along a track, through a little long grass, talking to the natives who accompanied me, about where I should camp. After passing this and going on along the edge of the tank for about 200 yards, I happened

to stop and look round, and saw a yellow animal bounding away through some very thin jungle about 400 yards away. I at first thought it was a deer; and I even put my rifle up in a careless sort of way, then I saw a long tail, and my thoughts ran to a ncelghal; the two natives also saw it. We went on, I being rather puzzled at the action and the tail of the beast. Presently, my *chokra* came up (who had been following me at about 200 yards) in an excited state, and said that as he was following me through this bit of grass, about twenty yards from the track, he saw a tiger crouching facing the path. He, naturally, being a servant and not a shikar, shouted out "Bagh," and the tiger went off into the jungle, and this was the beast we saw, and the others, who were behind, saw it as well. The inexplicable part of the business was that neither I, nor the two natives, who were both shikaris, and had seen lots of tigers, identified it as a tiger when we saw it. The only explanation I can offer is that a tiger was the last thing we expected to see, and we had been seeing on the way lots of deer of sorts.

#### SIMULTANEOUS TWIN PARTURITION OF *BUTHUS AFER*, THE BLACK ROCK SCORPION.

AN illustration will be found facing page 69 of this number of the Journal, which has been reproduced from a photograph taken by Mr. F. J. Kingsley. It consists of a common Black Rock Scorpion (*Buthus afer*) preserved by the Rev. Fr. Dreckmann, S. J., in the act of giving birth to two young ones simultaneously.

The Rev. Fr. Dreckmann writes as follows regarding this unique specimen:—

"It was caught with many others in Khandalla, during May, 1886, and was afterwards brought down to Bombay. They did not, however, survive their capture very long, but in a few months all succumbed to voluntary starvation. They were tempted with different kinds of food, but all to no avail, only now and then they would feast upon one of their number, and when the young ones appeared they were most greedily devoured by their elders. About the middle of June the young ones began to make their appearance. As soon as they were born they climbed upon the backs of their mothers, probably to be out of reach of her jaws, and it was noticed that the increase of the family was always by pairs. A closer examination settled beyond doubt two points: 1st, that at least this kind of scorpion is strictly viviparous, not ovo-viviparous, as stated by Duncan ("Transformation of Insects") and others; and, 2nd, that the birth of the pair takes place simultaneously, though very often one of the twins would be somewhat in advance of the other. The specimen presented to the Society was placed in alcohol and killed during the process of parturition, so as to be in evidence about the two points in question.

"Last May we were unfortunate, as all our scorpions died before any young ones were born; this year, however, Rev. Father Meyer, whose special pets they are, intends to take great care of them, and hopes to rear a sufficient number to be able to study their life-history, about which very little appears to be known.

"I have seen it stated that scorpions are such savage creatures that they are bound to lead a strictly solitary life, as the stronger one of two scorpions would invariably kill and eat the weaker one. This is a calumny, I think, as we have often found as many as 16 (two old ones and fourteen half-grown) under one stone, and as 14 was also the greatest number of young ones born by any one female in captivity, the presumption is that those 16 represented an undivided family."

Many writers on the subject refer to the double oviducts, which are apparent on dissection, but the Rev. Fr. Dreckmann appears to have been the first to notice and record the remarkable *simultaneous twin parturition* of this species of scorpion. The subject is one of the greatest interest, not only for the naturalist, but to the physiologist, and it is to be hoped that other members of this Society will contribute the result of their observations.

Mr. Lionel de Nicéville, F. E. S., has obtained from Mr. J. Wood-Mason, the Superintendent of the Indian Museum, Calcutta, the following interesting note on the simultaneous viviparous twin parturition of Black Rock Scorpion :—

“ Nothing, so far as I know or can discover, having been placed on record about the parturition of scorpions, I cannot say whether the twin births you have observed are usual or unusual. Such a point indeed is only to be settled by a multitude of observations of the same kind as that which you are about to record ; but whether they are the rule or only occasionally happen, would be readily explained by the bilateral symmetry of the genital organs, by the development of the embryos in pairs, and by the symmetrical action of the muscular mechanism of parturition. That scorpions bring forth living young, and do not lay eggs, has been, I need hardly say, long (more than fifty years) known to science.”

### CORRESPONDENCE.

#### THE PROTECTION OF GAME.

THE President of the Ahmedabad Municipality having asked the Bombay Natural History Society for an opinion as to what game birds and animals should be protected in the neighbourhood of Ahmedabad, under Act 20 of 1887, the following answer has been sent in reply :—

From the Honorary Secretary, Natural History Society, Bombay ;  
To the President, Ahmedabad Municipality.

*Bombay, 28th April, 1888.*

DEAR SIR,—I duly received your letter No. 248 of 3rd inst., and have laid the same before the Committee of the Society, who have expressed their opinion that any Act for the local protection of game, in order to be effective, should be as simple as possible.

They are of opinion that game in the neighbourhood of Ahmedabad would be sufficiently protected if it were made illegal for any one (not being a cultivator) to be in possession of game, living or dead, between the 15th of June and the 15th of October (unless, of course, the possessor could prove that it came into his keeping prior to the 15th June).

An exception should be made in favour of cultivators of the soil, who might be allowed to kill such animals and birds as are destructive to crops ; but game so destroyed should not be offered for sale.

I attach a list of the game birds and animals which, in the opinion of the Committee, should be protected. You will observe that the Grey Partridge and Grouse have been included in the list, although they both breed much earlier.

The above is the opinion of the Committee of the Society as regards the preservation of game, but I am requested to add that, as naturalists, the Committee would be glad to see all birds protected during the rains (i. e., 15th June to 15th October).—Yours, &c.,

H. M. PHIPSON,  
Honorary Secretary.

## LIST OF GAME BIRDS AND ANIMALS.

Name.	Time of Breeding.	Remarks.
Grouse .....	Cold weather principally ...	Grouse of sorts.
Bustard .....	July to September .....	.....
Floricau .....	July to October .....	.....
Grey Partridge .....	January to April, August and September .....	.....
Painted Partridge .....	August to October .....	.....
Quail .....	July to October ...	Quail of sorts.
Pea Fowl.....	Do. ....	.....
Ducks .....	August to October.....	(Non-migratory ducks.)
Jungle Fowl .....	May to July.....	.....
Spur Fowl .....	Do. ....	.....
Hares ...	At all seasons .....	.....
Antelopes (i. e., Nylghai, Black Buck, Chickara, & Bekri, &c.) ...	Principally during the rains.	.....
Deer (Sambur, Chital, &c.).	Do. ....	.....

## PROCEEDINGS OF THE SOCIETY.

## PROCEEDINGS OF THE MEETING OF 4TH JANUARY 1888.

THE usual Monthly Meeting of the Members of the Society took place on Wednesday the 4th January, and was largely attended. Dr. D. MacDonald presided.

The following new members were elected :—Mr. E. Giles, Captain K. Macaulay, Mr. Henry J. Eunson, C.E., Mr. G. C. McMullen, Mr. Shripad Babajee Thakur, C.S., Dr. D. A. DeMonte, Colonel C. E. Hussey, Mr. A. F. Appleton, A. V. D., Mr. C. E. Crawley, and Mr. J. C. Parker.

Mr. H. M. Phipson, the Honorary Secretary, then acknowledged receipt of the following contributions to the Society's collections :—

## CONTRIBUTIONS IN DECEMBER 1887.

Contributions.	Description.	Contributor.
A Quantity of Shells and Corallines.	From Alibag.....	Mr. W. F. Sinclair, C.S.
1 Snake.....	Bungarus arcuatus .....	Mr. A. E. Tittle.
1 Monitor (alive).....	Varanus dracaena.....	Mr. Sitaram V. Sukthankar.
2 English Pheasants and 1 Woodcock.....	Mounted ....	Mr. J. C. Anderson.
2 Ostrich's Eggs .....	Struthio camelus.....	Mr. G. C. McMullen.
1 Crocodile (alive) .....	Crocodilus palustris.....	Dr. L. B. Dhargalker.
1 Civit Cat (alive).....	Viverra civettina.....	Mr. Percy Benn.
1 Hedgehog .....	Erinaceus collaris .....	Rev. J. Abbott.
Skin of the large Tiger Cat.	Felis viverrina.....	Mr. H. T. Ommaney, C.S.
1 Snake .....	Trimeresurus anamallensis	Mr. F. Gleadow.
1 Owl (alive).....	Strix javanica.....	Mr. H. Littledale.
21 Birds' Eggs.....	From Baroda. ....	Mr. H. Littledale.
1 Snake .....	Daboia elegans.....	Mr. Lang.
2 Snakes (alive).....	Ptyas mucosus.....	Dr. D. DeMonte.
1 Snake Bird.....	Plotus melanogaster.....	H. E. Lady Beay.
1 Turtle (alive) .....	Chelonia virgata.....	Dr. J. F. Gonsalves.

Mr. N. S. Symons exhibited two mounted mahseer (*Barbus tor*) caught by him in the Bowani River, in 1886, which weighed 72½ lbs. and 65½ lbs., respectively.

The Honorary Secretary gave notice that at the February meeting the committee would propose that all persons joining the Society after the 1st March next be charged an entrance fee of Rs.10.

Dr. G. A. Maconachie was re-elected a Vice-President of the Society.

#### CONTRIBUTIONS TO THE LIBRARY.

*Prachin Sodhsangrah*, from H. H. Maharaja of Bhownugger. *The Ibis*, 1873 to 1878, Messrs. Thacker & Co. *Proceedings of the Zoological Society*, 1878 to 1885, Messrs. Thacker & Co. *Flora of British India* (Hooker), Part XIV., Bombay Government. *List of the Birds of India* (Hume), Mr. Frank Rose. *The Journal of Medicine*, No. 96-8, from Dr. T. L. Phipson.

Dr. D. MacDonald exhibited a curiously deformed foetus of a domestic cat.

#### PROCEEDINGS OF THE MEETING HELD ON 6TH FEBRUARY 1888.

THE usual monthly meeting of the Members of the Society took place on Monday, the 6th February. Dr. D. MacDonald presiding.

The following new members were elected:—Brigadier-General Pottinger, Mr. D. McLauchlan Slater, Mr. E. Freeborn, Colonel J. Hibbert, Mr. C. N. Clifton, C. E., Mr. G. P. Robinson, Lieut. D. Madhowrao, N.A., Dr. Shantaram Vinayak Kantik Mr. Dady Hormusjee C. Dadysett, Captain H. S. B. Hodgkinson, Mrs. Pearson, Mr. Furdoonjee Jamsetjee, Mr. J. S. Mure, Mr. D. A. Glazebrook, Mr. H. Chalmers, Mr. H. R. Cobbold, and Mr. Romanjee Eduljee Modi.

The following contributions to the Society's collections were acknowledged:—

#### CONTRIBUTIONS DURING JANUARY.

Contributions.	Description.	Contributor.
1 Snake .....	<i>Simotes Russellii</i> .....	Mias E. Atkinson.
1 Boar's Skull .....	<i>Sus indicus</i> .....	Dr. DeMonte.
1 Snake .....	<i>Lycodon striatus</i> .....	Mr. R. A. Sterndale.
1 Dolphin .....	<i>Delphinus plumbeus</i> .....	Mr. F. A. Little.
1 Pelican .....	<i>Pelecanus philippensis</i> ..	Mrs. Sheppard.
Bark Cloth .....	From Zanaibar .....	Mrs. Gallagher.
1 Spotted Owlet (alive)	<i>Carine brama</i> .....	Mr. P. R. Valladares.
1 Freshwater Fish (weigh- ing 74 lbs.) .....	<i>Bagarius Yarrellii</i> ... ..	Dr. A. Stewart.
1 Marbled Teal .....	<i>Querquedula angustiro-</i> <i>tris</i> .....	Mr. J. D. Inverarity.
1 Oryx's Head .....	From Somali Coast .....	Capt. W. G. Forbes.
1 Crocodile .....	<i>Crocodilus palustris</i> .....	Dr. DeMonte.
Egg of the Indian Bustard..	<i>Eupodotis Edwardii</i> .....	Mrs. Pearson.
1 Chameleon .....	<i>Chamæleo vulgaris</i> .....	Mr. S. A. Bulkley.
1 Crocodile's Head .....	<i>Crocodilus palustris</i> .....	Mr. A. R. M. Simkins.
1 Wood Snipe .....	<i>Gallinago nemoricola</i> ... ..	Mr. T. B. Sell.
1 Fish (mounted), 40 lbs...	<i>Barbus Malabaricus</i> .....	Mr. H. M. Phipson.
1 Owl (alive) .....	<i>Strix javanica</i> .....	Mr. H. Littledale.

*Minor Contributions*, from Dr. Weir, Mr. G. Carstensen, and Mr. Strong.

*Contributions to the Library*.—*Proceedings*, Linnæan Society of N. S. Wales, Vol. II., part 3; *Records of the Geological Survey of India*, Vol XX., part 4; *Comparative Anatomy of Vertebrates* (Owen), Mr. J. Westlake; *Catalogue of the Moths of India* (Cotes and Swinhoe), *Verhandlung der Zoologisch Botanischen Gesellschaft in Weim*, Vol. XXXVII., Nos. 3 and 4.



Mr. H. M. Phipson announced that the following books had been deposited in the Society's Library by him on loan for the use of the members :—

The Rod in India (Thomas).	A Naturalist's Rambles in China Seas (Collingwood).
The Thanatophidia of India (Fayrer).	History of Mammalia.
Malabar Fishes (Day).	Handbook of Cashmere (Ince).
Natural History, Reptiles (Wood).	Fish and Fishing (Manley).
Insecta Abroad (Wood).	Chapters on Evolution (Wilson).
The Aurelian (Harris).	Siberia in Europe (Seebohn).
Proc. Zoo. Society, January to June, 1887.	The Student's Darwin (Aveling).
Utilization of Minute Life (Phipson).	Notes on Collecting (Taylor).
Malay Archipelago (Wallace).	Studies in Animal Life (G. H. Lewes).
The Sportsman's Handbook (Ward).	Game Birds of India (Jerdon).
Transformation of Insecta (Duncan).	Animal Creation (Rymer Jones).
Animals and Plants under Domestication (Darwin).	Animal Locomotion (Pettigrew).
General Structure of the Animal Kingdom (Rymer Jones).	Destruction of Life by Snakes in India.
Wild Animals (Fortané Nott).	Beetles (Duncau).
	Matheran Hill (Smith).

Mr. H. M. Phipson exhibited a fine specimen of the Malabar carp (*Barbus Malabaricus*), which weighed about 40lbs. It was caught by him near Poona in December last, and had since been mounted by him for the Society's collection.

Mr. E. L. Barton exhibited several heads of deer, wild cat, and monkey mounted by him for members.

The accounts for the year 1887 were then submitted and explained to the meeting by the Honorary Treasurer, Mr. E. M. Slater, from which it appeared that the balance at the Bank of Bombay on 31st December last was Rs. 688-18. It was resolved that the accounts be passed.

The following resolution was then proposed by the Chairman, seconded by Mr. J. H. Steel, and carried unanimously :—"That in future an entrance fee of Rs. 10 be charged to all persons joining this Society."

PROCEEDINGS OF THE MEETING HELD ON 5TH MARCH 1888.

THE usual monthly Meeting of this Society took place on Monday, the 5th March. Dr. D. MacDonald presiding. Mr. T. D. Mackenzie, C.S., was elected a member.

The Honorary Secretary then acknowledged the following contributions :—

CONTRIBUTIONS DURING FEBRUARY.

Contribution.	Description.	Contributor.
1 Bees' Comb.....	From Aurungabad .....	Mr. Frank Rose.
1 Bittern .....	Botaurus stellaris .....	Mr. J. D. Inverarity.
2 Snakes (alive) .....	Echis carinata .....	Mr. H. M. Phipson.
A quantity of Barnacles ...	Mounted .....	Captain Dixon.
Orchid Bulbs .....	From Surat .....	Mr. F. Gleadow.
A number of Beetles .....	From Zanzibar.....	Rev. Etienne Baur.
20 Snakes .....	From Sikkim.....	Mr. Paul Möwis.
Eggs of Rock Horned Owl.	Bubo bengalensis.....	Mr. J. L. Lushington.
1 Grey-breasted Tragopan (alive).	Cerionia blythi .....	Mr. F. Mercer.
2 Flying Squirrels .....	Pteromys oral and another	Mr. E. A. Straw.
1 Jungle Cat .....	Felis chaus .....	Do.
2 Snakes .....	Echis carinata .....	Mr. H. Buckland.
1 Chameleon .....	Chamæleo vulgaris .....	Mr. P. Reynolds, C.E.
4 Musk Deer's Skulls .....	From Cashmere .....	Mr. E. L. Barton.
1 Jackal's Skull .....	Canis aureus.....	Do.
1 Fox's Skull.....	Vulpes bengalensis .....	Do.
1 Albino Parrot ... ..	.....	Rev. E. S. Hall.
1 Otter's Skull .....	Lutra nair.....	Mr. G. P. Millet, C.S.



BLACK ROCK-SCORPION (*DUTHUS AFER*)  
 (Found at Khamsala, Western Canada).  
 Exemplary specimen of the - paratype.